# GTR 225/GNC 255
# TSO Installation Manual

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## RECORD OF REVISIONS

| Revision | Revision Date | Description |
|---|---|---|
| A | 11/30/12 | Initial Release |
| B | 3/5/13 | Added ETSO information. See Current Revision Description for details. |
| | | |

## CURRENT REVISION DESCRIPTION

| Section Number | Description of Change |
|---|---|
| 1.3.4.2 | Updated the classes in the COM receiver specifications table. |
| 1.5 | Added DO- levels and ETSO information in Table 1-3. |
| 1.5.2 | Added deviation for ETSO-2C40c. |
| 6.4.2 | Added RS-232 table. |
| Appendix D | Updated Figure D-3. |
| | Updated Figure D-14. |

## DOCUMENT PAGINATION

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## DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

**WARNING**

*Warnings are used to bring to the installer's immediate attention that personal injury or death may occur if the instruction is disregarded.*

**CAUTION**

*Cautions are used to alert the individual that damage to equipment may result if the procedural step is not followed to the letter.*

**NOTE**

*Notes are used to expand and explain the preceding step and provide further understanding of the reason for the particular operation.*

**WARNING**

*This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.*

**WARNING**

*Perchlorate Material – special handling may apply.*
*see www.dtsc.ca.gov./hazardouswaste/perchlorate.*

**WARNING**

*This product contains a lithium battery that must be recycled or disposed of properly. Battery replacement and removal must be performed by professional services.*

**CAUTION**

*To avoid damage to the GTR 225 or GNC 255, take precautions to prevent Electro-Static Discharge (ESD) when handling the GTR, connectors, fan, and associated wiring. ESD damage can be prevented by touching an object that is of the same electrical potential as the unit before handling the unit itself.*

**NOTE**

*Garmin recommends installation of the GTR 225/GNC 255 by a Garmin-authorized installer. To the extent allowable by law, Garmin will not be liable for damages resulting from improper or negligent installation of the GTR 225/GNC 255. For questions, please contact Garmin Aviation Product Support at 888-606-5482.*

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## GTR 225/GNC 255 HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GTR 225, GTR 225A, GTR 225B, GNC 255A, and GNC 255B. Mod Levels are listed with the associated service bulletin number, service bulletin date, and the purpose of the modification. The table is current at the time of publication of this manual (see date on front cover) and is subject to change without notice. Authorized Garmin Sales and Service Centers are encouraged to access the most up-to-date bulletin and advisory information on the Garmin Dealer Resource web site at www.garmin.com using their Garmin-provided user name and password.

| MOD LEVEL | SERVICE BULLETIN NUMBER | SERVICE BULLETIN DATE | PURPOSE OF MODIFICATION |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

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# 1 GENERAL DESCRIPTION

## 1.1 Introduction

This manual is intended to provide mechanical and electrical information for use in the planning and design of an installation of the GTR 225, GTR 225A, GTR 225B, GNC 255A, or GNC 255B into an aircraft. This manual is not a substitute for an approved airframe-specific maintenance manual, installation design drawing, or complete installation data package. Attempting to install equipment by reference to this manual alone and without first planning or designing an installation specific to your aircraft may compromise your safety and is not recommended. The content of this manual assumes use by competent and qualified avionics engineering personnel and/or avionics installation specialists using standard aviation maintenance practices in accordance with Title 14 of the Code of Federal Regulations and other relevant accepted practices. This manual is not intended for use by individuals who do not possess the competencies and abilities set forth above. Refer to Section 2, Limitations, for additional information and other considerations.

## 1.2 Equipment Description

**Table 1-1. TSO-Certified Units**

| Model | Part Number | NAV Receiver | TX Power (Watt) | 8.33 KHz Spacing | 25 KHz Spacing |
|---|---|---|---|---|---|
| GTR 225 | 011-02718-00 | N/A | 10 | N/A | Yes |
| GTR 225A | 011-02807-00 | N/A | 10 | Yes | Yes |
| GTR 225B | 011-02808-00 | N/A | 16 | Yes | Yes |
| GNC 255A | 011-02806-00 | Yes | 10 | Yes | Yes |
| GNC 255B | 011-02719-00 | Yes | 16 | Yes | Yes |

**CAUTION**

*The GTR/GNC units have a display that is coated with a special anti-reflective coating that is very sensitive to waxes and abrasive cleaners. CLEANERS CONTAINING AMMONIA WILL HARM THE ANTI-REFLECTIVE COATING. It is very important to clean the display using a clean, lint-free cloth and an eyeglass lens cleaner that is specified as safe for anti-reflective coatings.*

**CAUTION**

*The use of ground-based cellular telephones while aircraft are airborne is prohibited by FCC rules. Due to potential interference with onboard systems, the use of ground-based cell phones while the aircraft is on the ground is subject to FAA regulation 14 CFR §91.21. FCC regulation 47 CFR §22.925 prohibits airborne operation of ground-based cellular telephones installed in or carried aboard aircraft. Ground-based cellular telephones must not be operated while aircraft are off the ground. When any aircraft leaves the ground, all ground-based cellular telephones on board that aircraft must be turned off. Ground-based cell phones that are on, even in a monitoring state, can disrupt GPS/SBAS performance.*

**NOTE**

*All screen shots used in this document are current at the time of publication. Screen shots are intended to provide visual reference only. All information depicted in screen shots, including software file names, versions, and part numbers, is subject to change and may not be up to date.*

## 1.3 Technical Specifications

### 1.3.1 Physical Characteristics

| Characteristics | Specifications |
|---|---|
| Bezel Height | 1.65 in (41.9 mm) |
| Bezel Width | 6.25 in (158.8 mm) |
| Rack Height (Dimple-to-Dimple) | 1.72 in (43.82 mm) |
| Rack Width | 6.30 in (160.02 mm) |
| Depth Behind Panel with Connectors (Measured from face of aircraft panel to rear of connector backshells) | 11.23 in |
| GTR 225 Weight (Unit Only) | 2.36 lbs (1.07 kg) |
| GNC 255 Weight (Unit Only) | 3.02 lbs (1.37 kg) |
| GTR 225 (Installed with rack and connectors) | 3.06 lbs (1.39 kg) |
| GNC 255 (Installed with rack and connectors) | 3.96 lbs (1.80 kg) |

### 1.3.2 General Specifications

| Characteristics | Specifications |
|---|---|
| Operating Temperature Range | -20°C to +55°C. For more details see Environmental Qualification Form on the Dealers Only page on www.garmin.com. See Appendix A for part numbers. |
| Humidity | 95% non-condensing |
| Altitude Range | -1,500 ft to 55,000 ft |
| Input Voltage Range (COM Connector) | 9 to 33 VDC |
| Input Voltage Range (NAV Connector) | 9 to 33 VDC |
| GTR Current Draw | Refer to Table 1-2 |
| Superflag Power Requirements | 320 mA maximum per superflag output |
| Environmental Testing | See Environmental Qualification Form on the Dealers Only page on www.garmin.com. See Appendix A for part numbers. |

### 1.3.3 Display

The display on the GTR/GNC is a sunlight readable LCD display.

| Characteristics | Specifications |
|---|---|
| Display Size | Width: 3.46” (88.0mm)<br>Height: 0.843” (21.4mm) |
| Active Area | Width: 2.95” (74.98mm)<br>Height: 0.486” (12.36mm) |
| Resolution | 200 x 33 pixels |
| Viewing Angle | Left: 45°<br>Right: 45°<br>Up: 10°<br>Down: 30° |

### 1.3.4 COM Specifications

#### 1.3.4.1 COM Transmitter Specifications

| Characteristics | Specifications |
|---|---|
| Classes | 3, 4, 5, 6 |
| Microphone Input | Two inputs, standard carbon or dynamic mic with integrated preamp providing minimum 70 mVRMS into 1000 Ω load |
| Modulation Capability | 85% with 100 to 1000 mVRMS microphone input at 1000 Hz |
| Modulation | AM Double sided<br>Emission Designator:<br>6K00A3E (118 - 136.975 MHz)<br>5K60A3E (118 - 136.992 MHz) |
| Frequency Range | 118.000 to 136.975 MHz, 25 kHz channel spacing<br>118.000 to 136.992 MHz, 8.33 kHz channel spacing |
| Frequency Tolerance | +/-2ppm from -40°C to +70°C |
| Output Power | 10 Watt Mode: 10 watts minimum<br>16 Watt Mode: 16 watts minimum |
| Duty Cycle | 10W: 100%<br>16W: Recommended 25% (5 seconds on/15 seconds off,<br>15 seconds on/45 seconds off, etc.) |
| Carrier Noise Level | At least 35 dB (SNR). |
| Stuck Mic Time-Out | 30 seconds time-out, reverts to receive |
| Demodulated Audio Distortion | Less than 5% distortion when the transmitter is at 85% modulation at 350 to 2500 Hz |
| Sidetone | 1.4 Vrms into a 500 Ω load |

### 1.3.4.2 COM Receiver Specifications

| Characteristics | Specifications |
|---|---|
| Classes | C,E, H1, and H2 |
| Frequency Range | 118.000 to 136.975 MHz, 25 kHz channel spacing<br>118.000 to 136.992 MHz, 8.33 kHz channel spacing |
| Headset Audio Output | 100 mW minimum into a 500 Ω load |
| Audio Response | Less than 6 dB of variation between 350 and 2500 Hz. |
| Audio Distortion | Less than 5% at rated output power |
| AGC Characteristics | Less than 3 dB of variation in the audio output from -93 to -13 dBm (power absorbed by a 50Ω load) |
| Sensitivity | SINAD on all channels is greater than 6 dB when the RF level is 2 uV (hard) or -107 dBm (power absorbed by a 50Ω load) modulated 30% at 1000 Hz at rated audio output power |
| Squelch | Automatic squelch with manual override |
| Selectivity | 6 dB BW is greater than ± 7 kHz for 25 kHz channeling.<br>60 dB BW is less than ±22 kHz for 25 kHz channeling.<br>6 dB BW is greater than ±3.5 kHz for 8.33 kHz channeling.<br>60 dB BW is less than ±7.37 kHz for 8.33 kHz channeling. |

### 1.3.5 VOR Specifications

| Characteristics | Specifications |
|---|---|
| Receiver Audio Sensitivity | At -103.5 dBm (S+N)/N is not less than 6 dB. |
| Course Deviation Sensitivity | -103.5 dBm or less for 60% of standard deflection. |
| Flag | The VOR/LOC Course Deviation Flag must be flagged when:<br>• RF signals are absent.<br>• 9960 Hz modulation is absent.<br>• either one of the two 30 Hz modulations are absent.<br>• the level of a standard VOR deviation test signal produces less than a 50% of standard deflection. |
| AGC Characteristics | From -99 dBm to -13 dBm input of a Standard VOR Audio Test Signal, audio output level does not vary more than 3 dB. |
| Spurious Response | Greater than 60 dB. |
| VOR OBS Bearing Accuracy | The bearing information as presented to the pilot does not have an error in excess of 2.7° as specified by RTCA DO-196 and EuroCAE ED-22B. |
| Audio Output | A minimum 100 mW into a 500Ω load. |
| Deflection Response | 0.5 to 2.7 seconds |
| Audio Response | Less than 6 dB of variation between 350 and 2500 Hz. In voice mode, an IDENT tone of 1020 Hz Ident Tone is attenuated at least 20 dB down. |
| Audio Distortion | The distortion in the receiver audio output does not exceed 10% at all levels up to 100 mW. |

### 1.3.6 LOC Specifications

| Characteristics | Specifications |
|---|---|
| Receiver Audio Sensitivity | At -103.5 dBm (S+N)/N is not less than 6 dB. |
| Course Deviation Sensitivity | At -103.5 dBm, deviation output is not to be less than 60% of standard deflection when a LOC deviation test signal is applied. |
| Flag | The VOR/LOC Course Deviation Flag is flagged when:<br>• the level of a standard LOC deviation test signal produces 50% or less of standard deflection of the deviation indicator.<br>• 150 Hz modulation is absent.<br>• 90 Hz modulation is absent.<br>• 90 Hz and 150 Hz modulation are both absent.<br>• RF signals are absent. |
| AGC Characteristics | From -99 dBm to -13 dBm input of a standard localizer audio test signal, audio output level does not vary more than 3 dB. |
| Selectivity | 6 dB BW is greater than 9 kHz<br>69 dB BW is less than 36 kHz |
| Standard Deflection | With a standard deflection 'FLY LEFT' condition (90 Hz dominant), the output is +90 mV ± 9 mV.<br>With a standard deflection 'FLY RIGHT' condition (150 Hz dominant), the output is -90 mV ± 9 mV. |
| Spurious Response | Greater than 60 dB |
| Centering Accuracy | 0 $\pm$ 0.01023 ddm or 0 $\pm$ 9.9 mV |
| Audio Output | A minimum 100 mW into a 500Ω load. |
| Audio Response | Less than 6 dB of variation between 350 and 2500 Hz. In voice mode, an IDENT tone of 1020 Hz Ident Tone is attenuated at least 20 dB down. |
| Audio Distortion | The distortion in the receiver audio output does not exceed 10% at all levels up to 100 mW. |

### 1.3.7 Glideslope Specifications

| Characteristics | Specifications |
|---|---|
| Sensitivity | -87 dBm or less for 60% of standard deflection. |
| Centering Accuracy | 0 ±0.01183 ddm or 0 ±10.14 mV |
| Selectivity | The course deviation is 0 ddm .0091 ddm when using the Glideslope Centering Test Signal as the RF frequency is varied ±17 kHz from the assigned channel.<br>At frequencies displaced by ±132 kHz or greater, the input signal is at least 60 dB down. |
| Standard Deflection | With a standard deflection 'FLY DOWN' condition (90 Hz dominant), the output is -78 mV ±7.8 mV.<br>With a standard deflection 'FLY UP' condition (150 Hz dominant), the output is +78 mV ±7.8 mV. |
| Flag | The unit flags when:<br>• the level of a standard glideslope deviation test signal produces 50% or less of standard deflection of the deviation indicator.<br>• 150 Hz modulation is absent.<br>• 90 Hz modulation is absent.<br>• 90 Hz and 150 Hz modulations are both absent.<br>• RF signals are absent. |

**Table 1-2. GTR/GNC Current Specifications**

| LRU | 14 Volt Current Draw | | 28 Volt Current Draw | |
|---|---|---|---|---|
| | Typical | Maximum | Typical | Maximum |
| **GTR 225** | | | | |
| COM Connector | 0.59 A | 4.2 A | 0.28 A | 1.9 A |
| **GTR 225A** | | | | |
| COM Connector | 0.59 A | 4.2 A | 0.28 A | 1.9 A |
| **GTR 225B** | | | | |
| COM Connector | 0.59 A | 5.9 A | 0.28 A | 2.6 A |
| **GNC 255A** | | | | |
| COM Connector | 0.59 A | 4.2 A | 0.28 A | 1.9 A |
| NAV Connector | 0.60 A | 1.16A | 0.30 A | 0.58 A |
| **GNC 255B** | | | | |
| COM Connector | 0.59 A | 5.9 A | 0.28 A | 2.6 A |
| NAV Connector | 0.60 A | 1.16A | 0.30 A | 0.58 A |

[1] The specified current draw is with the display backlight set to 100% and the fan operating. If the superflags are connected, their current draw must be added in addition to the specified current.

[2] The specified current draw does not include the superflags. If connected, their current draw must be added to the specified current. The superflags will supply up to 320 ma each regardless of the input voltage.

## 1.4 License Requirements

The Telecommunications Act of 1996, effective February 8, 1996, provides the FCC discretion to eliminate radio station license requirements for aircraft and ships. GTR/GNC installations must comply with current transmitter licensing requirements. In the US, to find out the specific details on whether a particular installation is exempt from licensing, please visit the FCC web site http://wireless.fcc.gov/aviation. If an aircraft license is required, make application for a license on FCC form 404, Application for Aircraft Radio Station License. The FCC also has a fax-on-demand service to provide forms by fax. Outside the US, contact the responsible telecommunication authority. The GTR/GNC owner accepts all responsibility for obtaining the proper licensing before using the transceiver. The maximum transmitting power, modulation identification, and frequency band information may be required for licensing and are detailed in Section 1.4.4.

**CAUTION**

*The VHF transmitter in this equipment is guaranteed to meet Federal Communications Commission acceptance over the operating temperature range. Modifications not expressly approved by Garmin could invalidate the license and make it unlawful to operate the equipment.*

## 1.5 Regulatory Compliance

**Table 1-3. TSO Authorization and Advisory Circular References**

| [1] | | | | | Function | TSO/ETSO/ SAE/RTCA/ EUROCAE | Class/Type | Applicable SW P/Ns | Applicable CLD P/Ns |
|---|---|---|---|---|---|---|---|---|---|
| GTR 225 | GTR 225A | GTR 225B | GNC 255A | GNC 255B | | | | | |
| | | | C | C | ILS Glideslope | TSO-C34e<br>DO-192<br>ETSO-2C34f<br>ED-47B | | 006-B0082-12 thru -1( )<br>006-B1374-03 thru -0( ) | 006-C0124-01 thru -0( ) |
| | | | C | C | ILS Localizer | TSO-C36e<br>DO-195<br>ETSO-2C36f<br>ED-46B | A | 006-B0082-12 thru -1( )<br>006-B1374-03 thru -0( ) | 006-C0124-01 thru -0( ) |
| | | | C | C | VOR | TSO-C40c<br>DO-196<br>ETSO2C40c<br>ED-22B | | 006-B0082-12 thru -1( )<br>006-B1374-03 thru -0( ) | 006-C0124-01 thru -0( ) |
| C [2] | C | C | C | C | Equipment That Prevent Blocked Channels | TSO-C128a<br>DO-207<br>ETSO-2C128<br>ED-67 | | 006-B1061-05 thru -0( )<br>006-B1374-03 thru -0( ) | 006-C0135-23 thru -2( ) |
| C [2] | C | C | C | C | COM Transceiver | TSO-C169a<br>DO-186B<br>ETSO-2C169a<br>ED-23C | 3, 4, 5, 6<br>C,E, H1,H2 | 006-B1061-05 thru -0( )<br>006-B1374-03 thru -0( ) | 006-C0135-23 thru -2( ) |

[1] **C** - Complete TSO
**I** - Incomplete TSO

[2] ETSO-2C128 and ETSO-2C169a are not applicable to the GTR 225.

### 1.5.1 Non-TSO Functions

There are no non-TSO functions.

**Table 1-4. System Functions**

| System Function | DO-178B/ED-12B Level | DO-254/ED-80 Level |
|---|---|---|
| Communication System | B | B |
| Display of VOR and ILS/LOC Navigation | B | B |
| Display of DME Navigation Information | B | B |
| Display of Database Information | B | N/A |

### 1.5.2 TSO Deviations

| TSO/ETSO | Deviation |
|---|---|
| **TSO-C34e** | 1. Garmin was granted a deviation from the TSO not to mark TSO number and software part number on the exterior of the unit. |
| | 2. Garmin was granted a deviation from the TSO to use RTCA/DO-160F instead of an earlier version as the standard for environmental conditions and test. |
| | 3. Garmin was granted a deviation from the TSO to use RTCA/DO-178B instead of an earlier version to demonstrate compliance for the verification and validation of the computer software. |
| **TSO-C36e** | 1. Garmin was granted a deviation from the TSO not to mark TSO number and software part number on the exterior of the unit. |
| | 2. Garmin was granted a deviation from the TSO to use RTCA/DO-160F instead of an earlier version as the standard for environmental conditions and test. |
| | 3. Garmin was granted a deviation from the TSO to use RTCA/DO-178B instead of an earlier version to demonstrate compliance for the verification and validation of the computer software. |
| **TSO-C40c** | 1. Garmin was granted a deviation from the TSO not to mark TSO number and software part number on the exterior of the unit. |
| | 2. Garmin was granted a deviation from the TSO to use RTCA/DO-160F instead of an earlier version as the standard for environmental conditions and test. |
| | 3. Garmin was granted a deviation from the TSO to use RTCA/DO-178B instead of an earlier version to demonstrate compliance for the verification and validation of the computer software. |
| **ETSO-2C40c** | 1. Garmin was granted a deviation from the ETSO to have a deflection response of 0.5 to 2.7 seconds. |
| **TSO-C128a** | 1. Garmin was granted a deviation from the TSO not to mark TSO number and software part number on the exterior of the unit. |
| | 2. Garmin was granted a deviation from the TSO to use RTCA/DO-160F instead of an earlier version as the standard for environmental conditions and test. |
| **TSO-C169a** | 1. Garmin was granted a deviation from the TSO not to mark TSO number and software part number on the exterior of the unit. |
| | 2. Garmin was granted a deviation from the TSO to use RTCA/DO-160F instead of an earlier version as the standard for environmental conditions and test. |

### 1.5.3 FCC Grant of Equipment Authorization

| Model | FCC ID | IC ID |
|---|---|---|
| GTR 225 | IPH-01594 | 1312A-01594 |
| GTR 225A | | |
| GTR 225B | | |
| GNC 255A | | |
| GNC 255B | | |

## 1.6 GTR/GNC Database

The GTR/GNC has a database of frequencies for airports and VORs.

Garmin requests that the flight crew report any observed discrepancies related to database information. These discrepancies could come in the form of an incorrect frequency, incorrectly identified airport, VOR, or other station, or any other displayed item used for navigation or communication in the air or on the ground. Go to flyGarmin.com and select "Aviation Data Error Report."

## 1.7 Aviation Limited Warranty

All Garmin avionics products are warranted to be free from defects in materials or workmanship for: two years from the date of purchase for new Remote-Mount and Panel-Mount products; one year from the date of purchase for new portable products and any purchased newly-overhauled products; six months for newly-overhauled products exchanged through a Garmin Authorized Service Center; and 90 days for factory repaired or newly-overhauled products exchanged at Garmin in lieu of repair. Within the applicable period, Garmin will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer will be responsible for any transportation cost. This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Garmin; or (v) damage to a product that has been modified or altered without the written permission of Garmin. In addition, Garmin reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT WILL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Garmin retains the exclusive right to repair or replace (with a new or newly-overhauled replacement product) the product or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY WILL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

**Online Auction Purchases:** Products purchased through online auctions are not eligible for warranty coverage. Online auction confirmations are not accepted for warranty verification. To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. Garmin will not replace missing components from any package purchased through an online auction.

**International Purchases:** A separate warranty may be provided by international distributors for devices purchased outside the United States depending on the country. If applicable, this warranty is provided by the local in-country distributor and this distributor provides local service for your device. Distributor warranties are only valid in the area of intended distribution. Devices purchased in the United States or Canada must be returned to the Garmin service center in the United Kingdom, the United States, Canada, or Taiwan for service.

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# 2 LIMITATIONS

## 2.1 Installation

Conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR part 43 or the applicable airworthiness requirements.

To mitigate against the loss of navigation and communication, installation of a second navigation and/or communication system may be required.

## 2.2 Aircraft Radio

An aircraft radio station license is not required when operating in U.S. airspace, but may be required when operating internationally.

As required by TSO-C169a, the quantitative safety objective for the VHF COM radio in the GTR/GNC is $1 \times 10^{-4}$ per flight hour for Class I Part 23 Airplanes, and $1 \times 10^{-5}$ per flight hour for all other Part 23 and Part 27 aircraft. To meet requirements for Part 23 Class II, Class III and Class IV, and Part 27 aircraft, it may be necessary to install a second VHF communications radio.

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# 3 INSTALLATION OVERVIEW

## 3.1 Introduction

Always follow acceptable avionics installation practices per AC 43.13-1B, AC 43.13-2B, or later FAA approved revisions of these documents. The communications installation instructions have been prepared to meet the guidance material defined by AC 20-67B, “Airborne VHF Communications Equipment Installations.”

## 3.2 Antenna Considerations

This section contains mounting location considerations for the antennas required for the GTR/GNC. For mounting the COM and NAV antennas, refer to the aircraft manufacturer’s data.

### 3.2.1 COM Antenna Location

The GTR/GNC COM antenna should be well removed from all projections, engines and propellers. The ground plane surface directly below the antenna should be a flat plane over as large an area as possible (18 inch square, minimum). The antenna should be mounted a minimum of six feet from any DME or other COM antennas, and four feet from any ADF sense antennas. The COM antenna should also be mounted as far apart as practical from the ELT antenna. Some ELTs have exhibited re-radiation problems that cause interference with other radios, including GPS. This can happen when the COM (GTR/GNC or any other COM) is transmitting on certain frequencies such as 121.15 or 121.175 MHz, which may cause the ELT output circuit to oscillate from the signal coming in on the ELT antenna coax.

If simultaneous use of two COM transceivers is desired (split-COM or simul-comm), the COM antennas should be spaced for maximum isolation. A configuration of one topside antenna and one bottom side antenna is recommended. The GTR/GNC does not require a transmit interlock, but other COM radios such as the GNS 530W may require it for split COM operations.

**NOTE**

*Canadian installations are required to meet Industry Canada specifications for maximum radiation as documented in Radio Specifications Standard 102 (RSS-102). For more information about RF exposure and related Canadian regulatory compliance, contact:*

*Manager, Radio Equipment Standards*
*Industry Canada*
*365 Laurier Avenue*
*Ottawa, Ontario*
*K1A 0C8*

*In accordance with Canadian Radio Specifications Standard 102 (RSS 102), RF field strength exposure to persons from an antenna connected to this device should be limited to 60V/m for controlled environment and 28 V/m for uncontrolled environment.*

### 3.2.2 Interference of GPS

On some installations, VHF COM transceivers, Emergency Locator Transmitter (ELT) antennas, and Direction Finder (DF) receiver antennas can re-radiate through the GPS antenna. Placement of the GPS antenna relative to a COM transceiver and COM antenna (including the GTR/GNC COM antenna), ELT antenna, and DF receiver antenna is critical.

Use the following guidelines, in addition to others in this document, when locating the GTR/GNC and its antennas.

- Locate the GTR/GNC as far as possible from all GPS antennas.
- Locate the COM antenna as far as possible from all GPS antennas.

If a COM antenna is found to be the problem, a 1.57542 GHz notch filter (Garmin P/N 330-00067-00) may be installed in the VHF COM coax, as close to the COM as possible. This filter is not required for the GTR/GNC transmitter.

If a COM is found to be radiating, the following can be done:

- Replace or clean VHF COM rack connector to ensure good coax ground.
- Place a grounding brace between the GTR/GNC, VHF COM and ground.
- Shield the VHF COM wiring harness.

## 3.3 GTR/GNC Mounting Considerations

The GTR/GNC is designed to mount in the avionics stack in the aircraft instrument panel within view and reach of the pilot. The primary unit location should minimize pilot head movement when transitioning between looking outside of the cockpit and viewing/operating the GTR/GNC. The location should be such that the GTR/GNC unit is not blocked by the glare shield on top, or by the throttles, control yoke, etc. on the bottom. If aircraft has a throw-over yoke, be sure the yoke does not interfere with the GTR/GNC.

## 3.4 Cabling and Wiring Considerations

Wiring should be installed in accordance with AC 43.13-1B Chapter 11. For dual GTR/GNC unit installations, care should be taken to ensure separation between wires of redundant systems to reduce the possibility of loss of navigation due to a single event. When wire separation cannot be achieved, the following issues should be addressed:

- It should not be possible for a cable harness to be exposed to wire chafing in a manner that both units fail simultaneously;
- The cable harness should not be located near flight control cables and controls, high voltage lines or fuel lines;
- The cable harness should be located in a protected area of the aircraft (e.g., isolated from engine rotor burst); and
- Do not route cable near high voltage sources.

**NOTE**

*Pigtail lengths should be less than 3.0 inches. Wiring which is required to be shielded must be shielded per Appendix D.*

Refer to Section 4.4.2 and Section 4.5 for connector and tooling information.

Refer to Section 4.6 for recommended coax cable.

Refer to Appendix D for the appropriate wiring connections to assemble the wiring connector.

Once the cable assemblies have been made, attach the cable connectors to the rear connector plate. After installing the mounting tube, attach the assembled connector plate. Route the wiring bundle as appropriate. Use 22 or 24 AWG wire for all connections. For power and ground, use the wire gauge specified in the interconnect drawing, then 22 AWG for the short length from the splice to the connector. Avoid sharp bends.

## 3.5 Air Circulation and Cooling

**CAUTION**

*To avoid damage to the GTR/GNC, take precautions to prevent Electro-Static Discharge (ESD) when handling the GTR/GNC, connectors, fan, and associated wiring. ESD damage can be prevented by touching an object that is of the same electrical potential as the GTR/GNC before handling the GTR/GNC itself.*

The GTR/GNC unit meets all requirements without external cooling. However, as with all electronic equipment, lower operating temperatures extend equipment life. Reducing the operating temperature by 15° to 20°C (27° to 36°F) reduces the mean time between failures (MTBF).

Units tightly packed in the avionics stack heat each other through radiation, convection, and sometimes by direct conduction. Even a single unit operates at a much higher temperature in still air than in moving air. Fans or some other means of moving the air around electronic equipment are usually a worthwhile investment.

The GTR/GNC has a cooling fan integrated into the chassis to draw forced-air cooling through the unit. There are inlets along the right side of the GTR/GNC chassis that allow air to flow through the unit. Ensure that there are no obstructions to the air inlets or fan exhausts. Air should be able to freely flow from the chassis inlets to the fan outlet on the rear of the unit.

## 3.6 Compass Safe Distance

After reconfiguring the avionics in the cockpit panel, if the GTR/GNC unit is mounted less than 12 inches from the compass, recalibrate the compass and make the necessary changes for noting correction data.

# 4 INSTALLATION PROCEDURES

## 4.1 Unit and Accessories

For description of units see Table 1-1.

**Table 4-1. Catalog Part Numbers**

| Model | Unit Only Kit | Standard Kit | Unit P/N |
|---|---|---|---|
| GTR 225 | 010-00998-00 | 010-00998-50 | 011-02718-00 |
| GTR 225A | 010-01026-00 | 010-01026-50 | 011-02807-00 |
| GTR 225B | 010-01027-00 | 010-01027-50 | 011-02808-00 |
| GNC 255A | 010-01025-00 | 010-01025-50 | 011-02806-00 |
| GNC 255B | 010-00999-00 | 010-00999-50 | 011-02719-00 |

**Table 4-2. Standard Kit Accessories**

| Model | Item | Part Number |
|---|---|---|
| GTR 225/225A/225B | Connector Kit | 011-02721-00 |
| | Backplate Assembly | 011-02722-00 |
| | Mounting Rack | 115-01613-00 |
| | Product Information Kit | K00-00554-10 |
| GNC 255A/GNC 255B | Connector Kit | 011-02721-10 |
| | Backplate Assembly | 011-02722-10 |
| | Mounting Rack | 115-01613-00 |
| | Product Information Kit | K00-00554-20 |

## 4.2 Miscellaneous Options

| Item | Garmin P/N | Mfg P/N |
|---|---|---|
| GPS 1.57542 GHz Notch Filter | 330-00067-00 | N/A |
| Connector, TNC, Male, Clamp | N/A | 031-4452 [1] |

[1] This part is not available from Garmin.

***Vendor Contact Information (provided for convenience only):***

Amphenol RF, Four Old Newtown Road, Danbury, CT 06810 Phone: 800-627-7100

## 4.3 Optional Reference Material

| Item | Garmin P/N |
|---|---|
| GTR 225 Pilot's Guide | 190-01182-00 |
| GNC 255 Pilot's Guide | 190-01182-01 |

## 4.4 Installation Materials Required but not Supplied

### 4.4.1 Accessories Required but not Supplied

The following installation accessories are required but not provided.

| Item | Requirements |
|---|---|
| COM Antenna | Meets TSO-C37( ) and C38( ) **or** TSO-C169( ). 50Ω, vertically polarized with coaxial cable |
| NAV Antenna | Meets TSO C40( ) and C36( ). 50Ω, horizontally polarized with coaxial cable. Note that if the NAV antenna is a combined VOR/LOC/GS antenna, it must meet TSO C40( ), C36( ), and C34( ). |
| Glideslope Antenna | Meets TSO C34( ). 50Ω, horizontally polarized with coaxial cable or low-loss splitter used with the VOR/LOC antenna. |
| Headphones | 500Ω nominal impedance |
| Microphone | Low impedance, carbon or dynamic, with transistorized pre-amp |

### 4.4.2 Materials Required but not Supplied (New Installations Only)

The GTR/GNC is intended for use with the standard aviation accessories. The following items are required for installation, but not supplied:

- Wire (MIL-W-22759/16 or equivalent)
- Shielded Wire (MIL-C-27500 or equivalent)
- Hardware - #6-32 x 100° Flat Head SS Screw [(MS24693, AN507R or other approved fastener) (6 ea.)] and #6-32 Self-Locking Nut [MS21042 or other approved fastener (6 ea.)]
- Push/Pull (manually resettable) Circuit Breakers
- Tie Wraps or Lacing Cord
- Ring Terminals (for grounding)
- Coaxial Cable (RG-400, RG-142B or equivalent – Refer to Table 4.8 for additional information)

## 4.5 Special Tools Required

Some of the connectors use crimp contacts. The table below identifies crimp tools required to ensure consistent, reliable crimp contact connections for the rear D-sub connectors.

**Table 4-3. Recommended Crimp Tools (or Equivalent)**

| Manufacturer | Hand Crimping Tool | 22 – 28 AWG (P1001 – P1005) | |
|---|---|---|---|
| | | Positioner | Insertion/ Extraction Tool |
| Military P/N | M22520/2-01 | M22520/2-09 | M81969/14-01<br>M81969/1-04 |
| Positronic | 9507-0-0-0 | 9502-4-0-0 | M81969/1-04 |
| ITT Cannon | 995-0001-584 | 995-0001-739 | 000849490<br>274-7048-000MIL |
| AMP | 601966-1 | 601966-6 | 91067-1<br>2031838-1 |
| Daniels | AFM8 | K42 | M81969/14-01<br>M81969/1-04 |
| Astro | 615717 | 615725 | M81969/14-01<br>M81969/1-04 |

**NOTE**

*Insertion/extraction tools from ITT Cannon are all plastic; others are plastic with metal tip.*

## 4.6 Coaxial Cable Installation

Follow the steps below for installation of the coaxial cables:

1. Route the coaxial cable to the radio rack location keeping in mind the recommendations of Section 3.2. Secure the cable in accordance with AC 43.13-1B Chapter 11, section 11.
2. Trim the coaxial cable to the desired length and install the TNC and BNC connectors per the cabling instructions on Figure 4-1 below. If the connector is provided by the installer, follow the connector manufacturer's instructions for cable preparation.

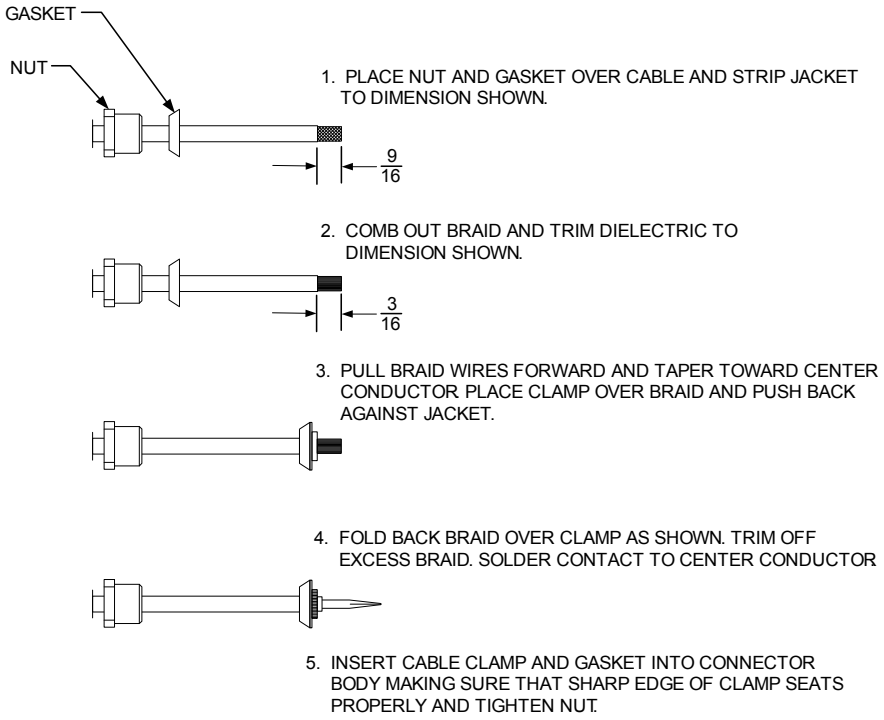

GASKET
NUT
1. PLACE NUT AND GASKET OVER CABLE AND STRIP JACKET TO DIMENSION SHOWN.
9/16
2. COMB OUT BRAID AND TRIM DIELECTRIC TO DIMENSION SHOWN.
3/16
3. PULL BRAID WIRES FORWARD AND TAPER TOWARD CENTER CONDUCTOR PLACE CLAMP OVER BRAID AND PUSH BACK AGAINST JACKET.
4. FOLD BACK BRAID OVER CLAMP AS SHOWN. TRIM OFF EXCESS BRAID. SOLDER CONTACT TO CENTER CONDUCTOR
5. INSERT CABLE CLAMP AND GASKET INTO CONNECTOR BODY MAKING SURE THAT SHARP EDGE OF CLAMP SEATS PROPERLY AND TIGHTEN NUT.

**Figure 4-1. Coaxial Cable Installation**

**Table 4-4. Socket Contact Part Numbers**

| Wire Gauge | Configuration Module 78-pin Connector (P1001) | P1001-P1005 |
|---|---|---|
| | 28 AWG [1] | 22-28 AWG [2] |
| Garmin P/N | 336-00021-00 | 336-00021-00 |
| Military P/N | N/A | M39029/58-360 |
| AMP | N/A | 204370-2 |
| Positronic | N/A | MC8522D |
| ITT Cannon | N/A | 010-2042-000 |

[1] For configuration module pins, ensure that the crimp tool is set to crimp 28 AWG wire (indenter setting of '4').

[2] Contacts listed are not to be used for configuration module wiring. Use the contacts supplied with the configuration module when installing configuration module wires in P1001.

[3] Non-Garmin part numbers shown are not maintained by Garmin and are subject to change without notice.

## 4.7 Equipment Mounting

### 4.7.1 Rack Installation

Use the dimensions shown in Figure C-1 to prepare the mounting holes for the GTR/GNC unit. You may also use the GTR/GNC unit mounting rack itself as a template for drilling the mounting holes.

1. Figure C-1 shows outline dimensions for the avionics rack for the various GTR/GNC units. Install the rack in a rectangular 6.32" x 4.60" hole (or gap between units) in the instrument panel. The lower-front lip of the rack should be flush with, or extend slightly beyond, the finished aircraft panel.

**NOTE**

*If the front lip of the mounting rack is behind the surface of the aircraft panel, the GTR/GNC unit connectors may not fully engage. See Figure C-7 for more information. Ensure that no screw heads or other obstructions prevent the unit from fully engaging in the rack (see the "Connector Engagement Test," Section 6.3). Exercise caution when installing the rack into the instrument panel. Deformation of the rack may make it difficult to install and remove the GTR/GNC unit.*

2. Install the rack in the aircraft panel using ten #6-32 flat head screws and ten self-locking nuts. The screws are inserted from the inside through the holes in the sides of the rack.
3. To attach the backplate to the rack, align the backplate so that the backplate screw heads pass through the keyed holes in the back of the rack.
4. Slide the backplate to the right (viewing from cockpit) until it clicks into place. Secure the backplate by tightening the four #4-40 screws.

### 4.7.2 GTR/GNC Unit Insertion and Removal

It may be necessary to insert the hex drive tool into the access hole and rotate the drive tool counterclockwise until it completely stops in order to ensure correct position of the retention mechanism prior to placing the unit in the rack. The GTR/GNC unit is installed in the rack by sliding it straight in until it stops, about 3/8 inch short of the final position. A 3/32-inch hex drive tool is then inserted into the access hole at the bottom of the unit face. Rotate the hex tool clockwise while pressing on the left side of the bezel until the unit is firmly seated in the rack.

To remove the unit from the rack, insert the hex drive tool into the access hole on the unit face. Rotate counterclockwise until the unit is forced out about 3/8 inch and the hex drive tool completely stops. This will allow the unit to be freely pulled from the rack.

Be sure not to over tighten the unit into the rack. The application of hex drive tool torque exceeding 15 in-lbs can damage the locking mechanism.

### 4.7.3 Unit Replacement

Whenever the GTR/GNC unit is removed or reinstalled, verify that the unit powers up successfully.

## 4.8 Antenna Installation and Connections

### 4.8.1 COM Antenna

The GTR/GNC unit requires a standard 50 Ω vertically polarized antenna. Follow the antenna manufacturer's installation instructions for mounting the antenna.

The antenna should be mounted on a metal surface or a ground plane with a minimum area of 18 inches x 18 inches. Refer to Section 3.2.1 for installation location considerations.

The antenna coax cable should be made of RG-142B, RG-400 or a comparable quality 50 Ω coax.

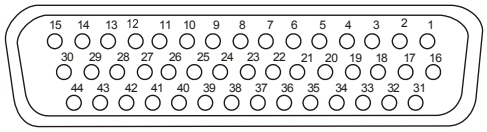
Check for insertion loss and Voltage Standing Wave Ratio (VSWR). VSWR should be checked with an in-line type VSWR/wattmeter inserted in the coaxial transmission line between the transceiver and the antenna. The VSWR should be inserted as close to the transceiver as possible. When rack and harness buildup is performed in the shop, the coax termination may be provisioned by using a 6-inch inline BNC connection. This would be an acceptable place to insert the VSWR. Any problem with the antenna installation is most likely seen as high reflected power. A VSWR of 3:1 may result in up to a 50% loss in transmit power.

# 5 CONNECTOR PINOUT INFORMATION

## 5.1 Pin Function List

### 5.1.1 P2001 Connector – COM Board

(View looking at rear of unit, Pin 1 is top right)



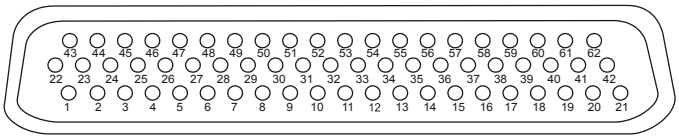

| Pin | Pin Name | I/O |
|---|---|---|
| 1 | RS-232 OUT 1 | Out |
| 2 | LIGHTING HI 2 | In |
| 3 | AUX AUDIO LINE LEVEL HI | In |
| 4 | RESERVED | -- |
| 5 | COM MIC 1 AUDIO IN HI | In |
| 6 | COM MIC 2 AUDIO IN HI | In |
| 7 | 500 Ω COM AUDIO HI | Out |
| 8 | LIGHTING HI 1 | In |
| 9 | RESERVED | -- |
| 10 | RESERVED | -- |
| 11 | COM MIC 1 KEY* | In |
| 12 | INTERCOM ENABLE* | In |
| 13 | SPEAKER OUT | Out |
| 14 | RESERVED | -- |
| 15 | RESERVED | -- |
| 16 | RS-232 IN 1 | In |
| 17 | RESERVED | -- |
| 18 | 500 Ω COM AUDIO LO | -- |
| 19 | AUX AUDIO LINE LEVEL GND | -- |
| 20 | MIC AUDIO IN LO | In |
| 21 | RESERVED | -- |
| 22 | LIGHTING LO 1 | In |
| 23 | RESERVED | -- |
| 24 | RESERVED | -- |
| 25 | RESERVED | -- |
| 26 | COM MIC 2 KEY* | In |
| 27 | COM REMOTE TRANSFER* | In |
| 28 | COM REMOTE TUNE UP* | In |
| 29 | COM REMOTE TUNE DOWN* | In |
| 30 | AIRCRAFT POWER | In |
| 31 | RS-232 GND | -- |
| 32 | LIGHTING LO 2 | In |
| 33 | RESERVED | -- |

| Pin | Pin Name | I/O |
|---|---|---|
| 34 | RESERVED | -- |
| 35 | RESERVED | -- |
| 36 | RESERVED | -- |
| 37 | AIRCRAFT GND | -- |
| 38 | AIRCRAFT GND | -- |
| 39 | SPEAKER GND | -- |
| 40 | AIRCRAFT GND | -- |
| 41 | RESERVED | -- |
| 42 | RESERVED | -- |
| 43 | AIRCRAFT POWER | In |
| 44 | AIRCRAFT POWER | In |

An asterisk (*) following a signal name denotes that the signal is an Active-Low, requiring a ground to activate. If there is no asterisk, the signal is an Active-High.

### 5.1.2 P2002 Connector – NAV Board

(View looking at rear of unit, Pin 1 is bottom left)




| Pin | Pin Name | I/O |
|---|---|---|
| 1 | VOR/LOC +TO | Out |
| 2 | VOR/LOC +FROM | Out |
| 3 | VOR/LOC +FLAG | Out |
| 4 | VOR/LOC -FLAG | Out |
| 5 | VOR/LOC +LEFT | Out |
| 6 | VOR/LOC +RIGHT | Out |
| 7 | RESERVED | -- |
| 8 | VOR/LOC COMPOSITE OUT | Out |
| 9 | VOR OBS ROTOR C | Out |
| 10 | VOR OBS ROTOR H (GND) | -- |
| 11 | VOR OBS STATOR E (GND) | -- |
| 12 | VOR OBS STATOR F | In |
| 13 | VOR OBS STATOR D | In |
| 14 | VOR OBS STATOR G (GND) | -- |
| 15 | VOR/LOC SUPERFLAG | Out |
| 16 | 500 Ω VOR/LOC AUDIO OUT HI | Out |
| 17 | 500 Ω VOR/LOC AUDIO OUT LO | Out |
| 18 | SERIAL DME - CLOCK | I/O |
| 19 | SERIAL DME - DATA | I/O |
| 20 | SERIAL DME - RNAV/CH REQ | In |
| 21 | SERIAL DME - RNAV MODE | In |
| 22 | AIRCRAFT GND | In |
| 23 | VOR/ILS ARINC 429 OUT B | Out |
| 24 | VOR/ILS ARINC 429 OUT A | Out |
| 25 | VOR OBI CLOCK | Out |
| 26 | VOR OBI SYNC | Out |
| 27 | VOR OBI DATA | Out |
| 28 | VLOC REMOTE TRANSFER | In |
| 29 | ILS ENERGIZE | Out |
| 30 | SPARE | -- |
| 31 | SPARE | -- |
| 32 | GLIDESLOPE +FLAG | Out |
| 33 | PAR DME 1 MHZ-D/SERIAL DME ON | Out |
| 34 | GLIDESLOPE +UP | Out |
| 35 | RESERVED | -- |
| 36 | RESERVED | -- |

| Pin | Pin Name | I/O |
|---|---|---|
| 37 | PAR DME 100 KHZ-A/SERIAL DME HOLD | Out |
| 38 | GLIDESLOPE SUPERFLAG | Out |
| 39 | PAR DME 100 KHZ-B | Out |
| 40 | PAR DME 100 KHZ-C | Out |
| 41 | DME COMMON | In |
| 42 | PAR DME 100 KHZ-D | Out |
| 43 | PAR DME 50 KHZ | Out |
| 44 | SERIAL DME - DME REQUEST | I/O |
| 45 | PAR DME 1 MHZ-A | Out |
| 46 | PAR DEM 1 MHZ-B | Out |
| 47 | PAR DME 1 MHZ-C | Out |
| 48 | RESERVED | -- |
| 49 | AIRCRAFT GND | In |
| 50 | RESERVED | -- |
| 51 | AIRCRAFT POWER | In |
| 52 | AIRCRAFT POWER | In |
| 53 | GLIDESLOPE - FLAG | Out |
| 54 | PAR DME 100 KHZ-E | Out |
| 55 | GLIDESLOPE +DOWN | Out |
| 56 | PAR DME 1MHZ-E | Out |
| 57 | RESERVED | -- |
| 58 | GLIDESLOPE COMPOSITE OUT | Out |
| 59 | RESERVED | -- |
| 60 | AIRCRAFT GND | In |
| 61 | AIRCRAFT GND | In |
| 62 | AIRCRAFT GND | In |

## 5.2 Power, Lighting, And Antennas

This section covers the power input requirements, lighting bus input, and antenna connections. See Appendix D for interconnect information.

### 5.2.1 Power

Power inputs P2001-30, P2001-43, and P2001-44 provide power for the COM radio. All three pins must be connected.

Power inputs P2002-51 and P2002-52 provide power for the NAV radio. Both pins must be connected.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| AIRCRAFT POWER | P2001 | 30 | In |
| AIRCRAFT POWER | P2001 | 43 | In |
| AIRCRAFT POWER | P2001 | 44 | In |
| AIRCRAFT POWER | P2002 | 51 | In |
| AIRCRAFT POWER | P2002 | 52 | In |
| AIRCRAFT GROUND | P2001 | 37 | In |
| AIRCRAFT GROUND | P2001 | 38 | In |
| AIRCRAFT GROUND | P2001 | 40 | In |
| AIRCRAFT GROUND | P2002 | 22 | In |
| AIRCRAFT GROUND | P2002 | 49 | In |
| AIRCRAFT GROUND | P2002 | 60 | In |
| AIRCRAFT GROUND | P2002 | 61 | In |
| AIRCRAFT GROUND | P2002 | 62 | In |

### 5.2.2 Lighting Bus

**CAUTION**

*Connection of the lighting bus to incorrect pins can cause damage to the unit that will require return to the factory for repair. Ensure that the lighting bus is connected to the correct pins and does not short to any adjacent pins prior to applying power to the unit, including the lighting bus.*

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| LIGHTING HI 1 | P2001 | 8 | In |
| LIGHTING HI 2 | P2001 | 2 | In |
| LIGHTING LO 1 | P2001 | 22 | In |
| LIGHTING LO 2 | P2001 | 32 | In |

### 5.2.3 Antennas

The COM and NAV antennas use BNC coaxial connectors on the connector backplate.

| Pin Name | Connector | I/O |
|---|---|---|
| COM ANTENNA | P2003 | I/O |
| NAV ANTENNA | P2004 | In |

### 5.2.4 Serial Data – RS-232

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| RS-232 OUT 1 | P2001 | 1 | Out |
| RS-232 IN 1 | P2001 | 16 | In |

#### 5.2.4.1 Aviation Out Type 1 and 2 Format

The GTR/GNC is capable of interfacing with other aviation instruments by receiving Aviation Out Type 2 data on RS-232 Input Port 1. The data consists of the following (refer to Section B.1 for a detailed data format description):

- Current latitude, longitude, and GPS altitude in feet (see note below)
- Current velocity vector (ground speed and direction of velocity vector over the ground)
- Distance to waypoint
- Cross track error
- Desired track
- Destination waypoint identifier
- Bearing to destination waypoint
- Magnetic variation
- Navigation and warning status
- Waypoint sequence in route
- Waypoint position (latitude and longitude) and magnetic variation

**NOTE**

*Aviation RS-232 data may be transmitted with or without the current GPS altitude in feet. Refer to Appendix B.*

#### 5.2.4.2 NMEA Format

##### 5.2.4.2.1 Legacy NMEA Support

The GTR/GNC maintains backwards compatibility with legacy SL30/SL40 NMEA commands ($PMMRC and $PMMRV) as they apply to GTR/GNC functionality. Refer to Appendix B.2.

The following legacy SL30/40 input commands are supported as-is:

- Set active COM frequency (SL30 version – only in 25 KHz spacing mode)
- Set active frequency and transceiver function (SL40 version – only in 25 KHz spacing mode)
- Set standby COM frequency. (SL30 version – only in 25 KHz spacing mode)
- Set standby frequency and transceiver function. (SL40 version – only in 25 KHz spacing mode)
- Set Omni-Bearing Select (OBS) value.
- Select squelch test (Squelch Override On/Off)

The following legacy SL30/40 input commands are supported with modifications to fit the GTR/GNC architecture:

- Set active VOR/LOC frequency: Set monitor mode ignored.
- Set standby VOR/LOC frequency: Set monitor mode ignored.
- Set NAV audio mode: Cannot turn off NAV audio.
- Set Volume Level and Audio Control Parameters: Only headphone, sidetone level, and RF squelch supported.
- Request data output: Cannot set speed.  Only unlisted command supported is Request Reset Status in both versions.

##### 5.2.4.2.2 NMEA GPS Data

The following NMEA standard GPS messages are used by the GTR/GNC for position source:

- Geographic Position, Latitude/Longitude ($GPGLL)
- Track Made Good and Ground Speed ($GPVTG)

##### 5.2.4.2.3 Input Commands

The following input command messages are supported:

- Request data output.
- Set Active NAV frequency (GNC ONLY)
- Set Standby NAV frequency (GNC ONLY)
- Set Active COM frequency
- Set Standby COM frequency
- Set Squelch Override
- Set COM Volume Level and Audio Control Parameters
- Set COM channel spacing
- Set NAV audio mode (GNC ONLY)
- Set Omni-Bearing Select (OBS) value (GNC ONLY)
- Set NAV Volume Level (GNC ONLY)

#### 5.2.4.3 COM Audio

#### 5.2.4.4 COM Audio Function

Activation of COM MIC 1 TRANSMIT enables MIC 1 AUDIO IN HI and causes the transceiver to transmit.

Activation of COM MIC 2 TRANSMIT enables MIC 2 AUDIO IN HI and causes the transceiver to transmit.

500Ω COM AUDIO is a 100 mW audio output that is intended to drive a headset or an audio panel.

#### 5.2.4.5 COM Audio Electrical Characteristics

##### 5.2.4.5.1 COM MIC AUDIO

MIC 1 and MIC 2 are standard carbon or dynamic mic inputs with integrated preamps providing minimum 70 mVrms into a 1000 Ω load.

MIC 1 and MIC 2 are set in the factory so that 100 mVrms modulates the transmitter to 85% nominally at 1000 Hz. The microphone gain adjustment is made through Configuration Mode.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| COM MIC 1 AUDIO IN HI | P2001 | 5 | In |
| COM MIC 2 AUDIO IN HI | P2001 | 6 | In |
| MIC AUDIO IN LO | P2001 | 20 | In |

##### 5.2.4.5.2 COM AUDIO

COM AUDIO supplies 100 mW into a 500Ω load. This is a balanced output and the LO output must be connected.

COM AUDIO is the summation of the COM receiver audio, COM sidetone audio, and intercom audio.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| 500 Ω COM AUDIO HI | P2001 | 7 | Out |
| 500 Ω COM AUDIO LO | P2001 | 18 | Out |

### 5.2.5 COM Discrete Inputs

Active-Low discrete inputs are considered active if either the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 Ω. These inputs are considered inactive if the voltage to ground is 6.5-33 VDC or the resistance to ground is >100 kΩ.

Active-High discrete inputs are considered active if the voltage to ground is >6.5 VDC. These inputs are considered inactive if the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 Ω.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| COM MIC 1 KEY* | P2001 | 11 | In |
| INTERCOM ENABLE* | P2001 | 12 | In |
| COM MIC 2 KEY* | P2001 | 26 | In |
| COM REMOTE TRANSFER* | P2001 | 27 | In |
| COM REMOTE TUNE UP* | P2001 | 28 | In |
| COM REMOTE TUNE DOWN* | P2001 | 29 | In |
| TEST MODE* | P2001 | 41 | In |

An asterisk (*) following a signal name denotes that the signal is an Active-Low, requiring a ground to activate. If there is no asterisk, the signal is an Active-High.

#### 5.2.5.1 COM MIC 1 KEY*

COM MIC 1 KEY* discrete input, when pulled low, allows the audio that is present on the COM MIC 1 AUDIO IN HI (P2001-5) to be transmitted over the radio.

#### 5.2.5.2 INTERCOM ENABLE*

The INTERCOM ENABLE* discrete input enables the intercom function of the GTR/GNC when grounded. This input can be connected to a switch, that, when activated, will enable the intercom function. There is also a menu option to enable the intercom if it is not desired to utilize a remote switch.

#### 5.2.5.3 COM MIC 2 KEY*

COM MIC 2 KEY* discrete input, when pulled low, allows the audio that is present on the COM MIC 2 AUDIO IN HI (P2001-6) to be transmitted over the radio.

#### 5.2.5.4 COM REMOTE TRANSFER*

COM REMOTE TRANSFER* discrete input may be used to flip-flop between the active and standby COM frequencies. A momentary low on this pin will load the standby COM frequency into the active COM frequency field and place the active frequency into the standby COM frequency field.

COM REMOTE TRANSFER* input may be used for emergency operation of the COM transmitter. If the switch is depressed for two seconds, the active COM frequency changes to 121.500 MHz. Once the emergency frequency is activated through COM REMOTE TRANSFER*, the GTR/GNC transceiver ignores inputs from the front panel controls for COM selections only. The pilot may exit this independent mode—restoring COM selection control to the front panel knobs and keys—by again depressing the switch for two seconds.

#### 5.2.5.5 COM REMOTE TUNE UP*

COM REMOTE TUNE UP* discrete input may be used to scroll through a list of preset COM frequencies. A momentary low on this pin will load the next preset frequency in the list into the standby COM frequency field.

#### 5.2.5.6 COM REMOTE TUNE DOWN*

COM REMOTE TUNE DOWN* discrete input may be used to scroll through a list of preset COM frequencies. A momentary low on this pin will load the previous preset frequency in the list into the standby COM frequency field.

### 5.2.6 VOR/ILS Audio

500 Ω VOR/LOC AUDIO OUT HI supplies 100 mW into a 500Ω load. It is a balanced output and the 500 Ω VOR/LOC AUDIO OUT LO output must be connected.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| 500 Ω VOR/LOC AUDIO OUT HI | P2002 | 16 | Out |
| 500 Ω VOR/LOC AUDIO OUT LO | P2002 | 17 | Out |

### 5.2.7 VOR/ILS Discrete Inputs

This input is considered active if either the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 Ω. This input is considered inactive if the voltage to ground is 11-33 VDC or the resistance to ground is >100k Ω.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VLOC REMOTE TRANSFER* | P2002 | 28 | In |

An asterisk (*) following a signal name denotes that the signal is an Active-Low, requiring a ground to activate.

#### 5.2.7.1 VOR/LOC REMOTE TRANSFER*

VOR/LOC REMOTE TRANSFER* discrete input may be used to flip-flop between the active and standby NAV frequencies. A momentary low on this pin will load the standby NAV frequency into the active NAV frequency field.

### 5.2.8 VOR/ILS Indicator

VOR/ILS indicator displays both lateral and vertical, To/From indications, lateral and vertical flags and superflags. Connector P1004 always outputs the VOR/Localizer/Glideslope navigation information. The VOR/ILS pins on P1004 are used to drive an indicator that displays VOR/ILS information at all times, regardless of the CDI selection on the GTR/GNC.

VOR/LOC COMPOSITE OUT is a standard VOR/localizer composite output signal which may be used to drive Left/Right, To/From, and Flag indications of certain navigation indicators that contain an internal converter.

ILS ENERGIZE output becomes active (low) when VOR/LOC frequency is set to a localizer channel.

#### 5.2.8.1 VOR/ILS Indicator Electrical Characteristics

##### 5.2.8.1.1 Superflags

The output supplies not less than 320 mA with the output voltage not less than (AIRCRAFT POWER -2 VDC) when the flag is to be OUT OF VIEW. The output voltage with respect to ground is 0 +/-250 mVDC when the flag is to be IN VIEW.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR/LOC SUPERFLAG* | P2002 | 15 | Out |
| GLIDESLOPE SUPERFLAG* | P2002 | 38 | Out |

##### 5.2.8.1.2 Deviation

Deviation outputs are each capable of driving up to three 1000Ω loads with ±150 mVDC ±15 mVDC for full-scale deflection, 0 mVDC ±4.5 mVDC when centered. The drive circuit provides for more than full-scale deflection with a maximum course deviation output voltage of ±300 mVDC ±30 mVDC.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR/LOC +LEFT | P2002 | 5 | Out |
| VOR/LOC +RIGHT | P2002 | 6 | Out |
| GLIDESLOPE +UP | P2002 | 34 | Out |
| GLIDESLOPE +DOWN | P2002 | 55 | Out |

##### 5.2.8.1.3 TO/FROM

TO/FROM output is capable of driving up to three 200Ω loads. When indicating TO, the output is +225 ±75 mVDC. When indicating FROM, output is -225 ±75 mVDC. When invalid information is present (Flag IN VIEW) the TO/FROM output is 0 ±10 mVDC.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR/LOC +TO | P2002 | 1 | Out |
| VOR/LOC +FROM | P2002 | 2 | Out |

#### 5.2.8.1.4 Flag

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR/LOC +FLAG | P2002 | 3 | Out |
| VOR/LOC -FLAG | P2002 | 4 | Out |
| GLIDESLOPE +FLAG | P2002 | 32 | Out |
| GLIDESLOPE -FLAG | P2002 | 53 | Out |

#### 5.2.8.1.5 OBS

VOR OBS ROTOR C and H are a buffered 400 Hz output that is intended to drive the OBS rotors. VOR OBS STATOR D and VOR OBS STATOR F are each phase and amplitude shifted version of the VOR ROTOR C output. Each pair is intended to read one of the two windings of the indicator's OBS stator.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR OBS ROTOR C | P2002 | 9 | Out |
| VOR OBS ROTOR H (GND) | P2002 | 10 | -- |
| VOR OBS STATOR D | P2002 | 13 | In |
| VOR OSB STATOR E (GND) | P2002 | 11 | -- |
| VOR OBS STATOR F | P2002 | 12 | In |
| VOR OBS STATOR G (GND) | P2002 | 14 | -- |

#### 5.2.8.1.6 VOR/LOC COMPOSITE

With a standard VOR test signal applied, VOR/LOC COMPOSITE OUT is 0.5 ± 0.1 Vrms into a 10 kΩ load. With a standard Localizer centering test signal applied, VOR/LOC COMPOSITE OUT is 0.350 ±0.05 Vrms into a 10 kΩ load.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR/LOC COMPOSITE OUT | P2002 | 8 | Out |

#### 5.2.8.1.7 GLIDESLOPE COMPOSITE

With a standard glideslope test signal applied, GLIDESLOPE COMPOSITE OUT is 0.350 $\pm$ 0.05 Vrms into a 10 kΩ load.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| GLIDESLOPE COMPOSITE OUT | P2002 | 58 | Out |

#### 5.2.8.1.8 NAV ILS ENERGIZE

The driver output voltage is not more than 1.0 V when sinking 20 mA. The maximum off state leakage current with respect to GND is less than 10 μA.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| ILS ENERGIZE | P2002 | 29 | Out |

### 5.2.9 RMI/OBI

#### 5.2.9.1 RMI/OBI Function

VOR OBI output provides bearing information from the currently tuned VOR station for Bendix/King Serial OBI devices based upon the VOR receiver. When a localizer channel is tuned on the VOR/LOC window, there is a bit in the data stream set to indicate that a localizer frequency is tuned which stows the needle or drives it to the 3 o'clock position.

#### 5.2.9.2 RMI/OBI Electrical Characteristics

The output driver is an Active-Low. The driver output voltage is not more than 1.0 V when sinking 20 mA. The maximum off state leakage current with respect to ground is less than 10 μA.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| VOR OBI CLOCK | P2002 | 25 | In |
| VOR OBI SYNC | P2002 | 26 | In |
| VOR OBI DATA | P2002 | 27 | In |

### 5.2.10 DME Tuning

#### 5.2.10.1 DME Tuning Function

The GTR/GNC can channel a DME based on the tuned VOR/LOC frequency. The GTR/GNC 2 of 5, BCD, or Slip parallel DME and King Serial DME channeling format. When DME COMMON is held low, the GTR/GNC actively tunes the DME.

#### 5.2.10.2 DME Tuning Electrical Characteristics

##### 5.2.10.2.1 Parallel DME Tuning

For each of the parallel DME tuning discrete outputs, the driver output voltage is not more than 1.0 V while sinking 20 mA. The maximum off state leakage current with respect to ground is less than 10 μA.

DME COMMON must be pulled low to indicate to the GTR/GNC that it is the device channeling the DME.

DME COMMON is considered active if either the voltage to ground is less than 1.9 V or the resistance to ground is less than 375 Ω. These inputs are considered inactive if the voltage to ground is 11-33 VDC.

Pins 37, 40, 41, 42, 43, 45, 47, 33, 54, and 56 are configured for 2 of 5 parallel DME tuning.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| PAR DME 100KHZ-A/SERIAL DME ON | P2002 | 37 | Out |
| PAR DME 100KHZ-B | P2002 | 39 | Out |
| PAR DME 100KHZ-C | P2002 | 40 | Out |
| PAR DME 100KHZ-D | P2002 | 42 | Out |
| PAR DME 100KHZ-E | P2002 | 54 | Out |
| PAR DME 50KHZ | P2002 | 43 | Out |
| PAR DME 1MHZ-A | P2002 | 45 | Out |
| PAR DME 1MHZ-B | P2002 | 46 | Out |
| PAR DME 1MHZ-C | P2002 | 47 | Out |
| PAR DME 1MHZ-D/SERIAL DME ON | P2002 | 33 | Out |
| PAR DME 1MHZ-E | P2002 | 56 | Out |
| DME COMMON | P2002 | 41 | In |

#### 5.2.10.2.2 King Serial DME Tuning

When SERIAL DME – DATA or SERIAL DME – CLOCK is asserted high and driving a 360 Ω load, the driver output voltage is not less than 8 V, and when asserted low is not greater than 10 mV.

SERIAL DME – RNAV/CH REQ, SER DME – RNAV MODE, and DME COMMON are considered active if either the voltage to ground is less than 1.9 V or the resistance to ground is less than 375 Ω. These inputs are considered inactive if the voltage to ground is 11-33 VDC.

DME COMMON must be pulled low to indicate to the GTR/GNC that it is the device channeling the DME.

Pins 18, 19, 20, and 41 are configured for King Serial DME tuning.

| Pin Name | Connector | Pin | I/O |
|---|---|---|---|
| SERIAL DME - DATA | P2002 | 19 | I/O |
| SERIAL DME - CLOCK | P2002 | 18 | I/O |
| SERIAL DME - RNAV/CH REQ | P2002 | 20 | In |
| SERIAL DME - RNAV MODE | P2002 | 21 | In |
| DME COMMON | P2002 | 41 | In |
| SERIAL DME - DME REQUEST | P2002 | 44 | I/O |

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# 6 POST INSTALLATION CONFIGURATION AND CHECKOUT PROCEDURES

## 6.1 System Configuration Overview

This section contains instructions for configuring the GTR/GNC for each installation as well as checks to ensure the system is properly installed and functioning correctly. A summary of the steps required for configuration and checkout of the GTR/GNC is as follows:

- Perform the installation checks (Section 6.5)
- Configure the GTR/GNC for the specific installation (Section 6.4)
- Perform ground checks to verify the interfaces to external sensors (Section 6.6)
- Perform the specified flight checks (Section 6.7)
- Update the aircraft documentation (Section 6.9)

## 6.2 Mounting, Wiring, and Power Checks

Verify that all cables are properly secured and shields are connected to the shield block of the connectors. Check the movement of the flight and engine controls to verify there is no interference between the cabling and control systems. Ensure that all wiring is installed as described in Section 3.4.

Prior to powering up the GTR/GNC, the wiring harness must be checked for proper connections to the aircraft systems and other avionics equipment. Point to point continuity must be checked to expose any faults such as shorting to ground. Any faults or discrepancies must be corrected before proceeding.

After accomplishing a continuity check, perform power and ground checks to verify proper power distribution to the GTR/GNC. Any faults or discrepancies should be corrected at this time. Remove power from the aircraft upon completion of the harness checkout.

The GTR/GNC can be installed after completion of the continuity and power checks. The GTR/GNC should be installed into the rack and secured appropriately, as described in Section 4.7.1. The GTR/GNC must be connected to the wiring harness and antennas.

**CAUTION**

*When 14 VDC or 28 VDC lighting buses are connected to the GTR/GNC, connection of the aircraft lighting bus to the incorrect input pins can cause damage to the GTR/GNC. Always start this test with the dimming bus at the lowest setting, and slowly increase the brightness. If it is noticed that the lighting level on the GTR/GNC does not increase as the lighting bus input is increased in brightness, verify that the wiring is correct before proceeding.*

## 6.3 Connector Engagement Check

Prior to configuration and checkout of the GTR/GNC, the connector engagement should be checked as described below:

1. Turn on the avionics master switch (if installed).
2. Place the GTR/GNC in the rack and engage the cam mechanism.
3. Turn the Allen screw of the locking cam (located on the lower left side of the unit) slowly clockwise until the GTR/GNC just powers on. A T-handle can be used for this, but ensure that the screw is not over-tightened.
4. Count the number of complete revolutions the Allen screw can be turned until it cannot turn any more. Take care not to over-tighten. Three turns is the minimum for proper installation. If fewer than three turns are possible, the mounting rack should be moved aft (toward the pilot) such that the aircraft panel does not obstruct the unit from properly engaging in the rack.

## 6.4 Configuration Mode Operations

The configuration pages shown in this section reflect main software version 2.00. Some differences in operation may be observed when comparing the information in this manual to later software versions.

Configuration mode is used to configure the GTR/GNC settings for each specific installation. To access configuration mode, remove power from the GTR/GNC. With the GTR/GNC turned off, press and hold the **ENT** key and apply power to the GTR/GNC by turning the COM volume knob clockwise. Release the **ENT** key when the display activates and 'Garmin' appears on the screen.

The first page displayed is the Config Mode page. While in configuration mode, pages can be selected by turning the outer knob to select the high-level page, turning the inner knob to select the subpage, and then pressing the **ENT** key to select the desired page. There are five main page headings: SYS, NAV, COM, AUD, and LOG. From the main heading, turn the inner knob to select the desired subpage and then press the **ENT** key. See Figure 6-1.

**Figure 6-1. Configuration Mode Home Page**

### 6.4.1 SYS Configuration

#### 6.4.1.1 Serial Port

The Serial Port page (Figure 6-2) allows the installer to configure the I/O mode for the RS-232 port. See Table 6-1 for the selections that are available:

**Figure 6-2. Serial Port Page**

**Table 6-1. Serial Port Selections**

| Selection | Description |
|---|---|
| NONE | No unit(s) connected to input/output of this channel. |
| AVN IN/MAPCOM | Serial data transfer with the GTN 6XX/7XX and GNS 400W/500W series. |
| NMEA | Serial data transfer with G500/G600, GPSMap, Aera Series, XL Series, or GX Series. |

#### 6.4.1.2 DST Display

The DST Display page (Figure 6-3) allows the installer to configure source priority for the display of distance, speed, time (DST) information, if both GPS and DME systems are providing data to the GNC. The GNC can display DST data from a DME or GPS device. Select “GPS, DME” to give priority to DST data from a connected GPS receiver or “DME, GPS” to give priority to DST data from a connected DME receiver.

**Figure 6-3. DST Display Page**

#### 6.4.1.3 Intercom Enable

The Intercom Enable page (Figure 6-4) allows the installer to configure which intercom mode is enabled or disabled. See Table 6-2 for available selections.

**Figure 6-4. Intercom Enable Page**

**Table 6-2. Intercom Enable Page Selections**

| Selection | Description |
|---|---|
| DISPLAY | Allows the intercom to be enabled or disabled via a menu option on the GTR/GNC display. After selecting 'Display, the intercom enable/disable setting will appear in normal mode. |
| DISCRETE | Selecting "DISCRETE" allows the intercom to be enabled or disabled via a remote switch connected to the INTERCOM ENABLE* discrete input (P2001-12). This selection will remove the menu option to enable/disable the intercom. |

#### 6.4.1.4 Backlight

The Backlight page (Figure 6-5) allows the installer to select the source for the display and bezel key lighting. Minimum brightness levels of the display and key are also configured on the Backlight page.

**Figure 6-5. Backlight Page**

The display source can be configured to track either the photocell or lighting bus 1. The bezel key source can be configured to track the photocell, lighting bus 1, or lighting bus 2. See Table 6-3 for description of selections on the Backlight page.

**Table 6-3. Backlight Selections**

| Selection | Description |
|---|---|
| PHOTOCELL | Backlight or bezel key lighting level is determined by the ambient light level as measured by the photocell on the GTR/GNC. |
| LIGHTING BUS 1 | Backlight or bezel key levels track the lighting bus 1 levels. |
| LIGHTING BUS 2 | Bezel key lighting levels track the lighting bus 2 levels. |

The minimum brightness level of the display and bezel keys can also be configured on the Backlight page. This will set the minimum brightness of the bezel keys or display. The display minimum brightness level has a range from 1 to 100. The default level is 1. The bezel key minimum brightness level has a range from 0 to 100. The default level is 1.

### 6.4.1.5 Photocell

The Photocell page (Figure ) allows the installer to configure the parameters of the photocell. See Table 6-4 for description of each parameter.

**Figure 6-6. Photocell Page**

**Table 6-4. Photocell Page Parameter Description**

| Selection | Description |
|---|---|
| TRNSN (Transition) | When a lighting bus is used to control the lighting of the display, this parameter sets the point on the lighting bus control below which the display brightness tracks the GTR/GNC photocell. This field has a range of 5 to 50, and is set to 25 as the default setting. |
| SLOPE | Sets the sensitivity the brightness of the display or keys has to changes in the photocell input level. Adjusting the slope higher will result in a brighter display for a given increase in the photocell input level. This field has a range of 0 to 100, and is set to 50 as the default setting. |
| KEY CO (Key Cutoff) | This parameter configures the point at which key backlighting is switched off in bright light. For example, a value of 70 results in the key backlights being turned off at photocell source input levels above 70%. This field has a range of 0 (zero) to 100 and is set to 80 as the default setting. |
| OFFSET | Adjusts the lighting level up or down for any given photocell input level. This field has a range of 0 (zero) to 100, and is set to 50 as a default value. This may also be used to match lighting curves with other equipment in the panel. |

### 6.4.1.6 Lighting Bus 1 and Lighting Bus 2

The Lighting Bus 1 and Lighting Bus 2 page (Figure 6-7) allows the installer to configure the parameters of each lighting bus. See Table 6-5 for descriptions of each parameter.

**Figure 6-7. Lighting Bus Page**

**Table 6-5. Lighting Bus Parameter Description**

| Selection | Description |
|---|---|
| INPUT | This setting configures the lighting bus source voltage. Select **14 VDC**, **28 VDC**, **5 VDC**, or **5 VAC**, depending on the lighting bus voltage source. |
| SLOPE | This setting determines how sensitive the display or bezel keys are to changes in the lighting bus input level. Adjusting the slope higher will result in a brighter display for a given increase in the lighting bus input level. This field has a range of 0 to 100, and is set to 50 as the default setting. |
| OFFSET | This setting adjusts the lighting level up or down for any given lighting bus input level. This field has a range of 0 (zero) to 100, and is set to 50 as a default value. This may also be used to match lighting curves with other equipment in the panel. |

### 6.4.1.7 Display Information

The Display Information page (Figure 6-8) allows the installer to view and verify the display software version, part number, serial number, minimum software level, hardware version, boot version, part number and minimum boot version of the unit.

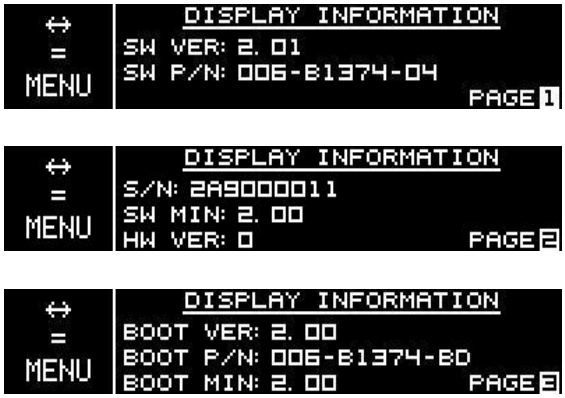


**Figure 6-8. Display Information Pages**

#### 6.4.1.8 Display Update

The Display Update page (Figure 6-9) allows the installer to load the display software to the GTR/GNC. Refer to Section 6.8 for instructions on how to load software to the GTR/GNC.

**NOTE**

*Garmin recommends the use of a USB 2.0 compatible USB flash drive for updating databases and software on the GTR/GNC.*

**Figure 6-9. Display Update Page**

### 6.4.2 NAV Configuration (GNC Only)

#### 6.4.2.1 CDI Indicator

The CDI Indicator page (Figure 6-10) allows the installer to configure the type of Course Deviation Indicator (CDI) that is connected to the GNC. The setting is based upon the connected CDI. See Table 6-6 for settings.

**Figure 6-10. CDI Indicator Page**

**Table 6-6. CDI Indicator Selections**

| Selection | Description |
|---|---|
| NONE (DEFAULT) | No external resolver is supported. OBS mode allows the user to edit the OBS with concentric knobs. Serial OBS update messages are supported in this mode, but the unit will not flag if updates are discontinued or are not periodic. |
| RESOLVER | Auto-decodes resolver setting via six-wire resolver interface. Uses internal DSP to compute course information. See Section 6.5.1 for calibration. |
| CONVERTER | Disables all internal OBS functions. Allows use of conventional external converter via the composite output pin. |
| SERIAL | For use with serial Electronic Flight Instruments (EFIS) conforming to the Garmin Serial Data Specification. See Appendix B. |

#### 6.4.2.2 ARINC 429 (GNC Only)

The ARINC 429 page (Figure 6-11) allows the installer to configure the NAV ARINC 429 output on the GNC. Configure the port according to the connected VOR/ILS indicator. See Table 6-7 and Table 6-8 for description of the configuration speeds.

**Figure 6-11. ARINC 429 Page**

**Table 6-7. ARINC 429 Configuration Speed (TX)**

| Selection | Description |
|---|---|
| LO SPEED | Standard low-speed ARINC 429 (nominally 12.5 kilobits per second) |
| HI SPEED | High-speed ARINC 429 (nominally 100 kilobits per second) |

**Table 6-8. SDI Selections**

| Selection | Description |
|---|---|
| COMMON | Generates all 429 outputs with SDI = 0 |
| VOR/ILS 1 | Number 1 (Pilot) VOR/ILS Receiver<br>TX: Generates all 429 outputs with SDI = 1 |
| VOR/ILS 2 | Number 2 (Copilot) VOR/ILS Receiver<br>TX: Generates all 429 outputs with SDI = 2 |
| SERIAL | For use with serial Electronic Flight Instruments (EFIS) conforming to the Garmin Serial Data Specification. See Appendix B |

#### 6.4.2.3 DME Configuration (GNC Only)

Select the DME configuration page to configure the DME channel mode settings.

##### 6.4.2.3.1 Mode (DME Channel Mode)

This configuration setting allows the installer to set the format for DME tuning data output. See Table 6-9 for DME settings.

**Table 6-9. DME Settings**

| Selection | Description |
|---|---|
| King Serial | King Serial DME tuning data |
| Parallel 2x5 | 2 of 5 parallel DME tuning |
| Parallel BCD | Shifted BCD (Binary Coded Decimal) parallel DME tuning |
| Parallel Slip | Slip-code parallel DME tuning |
| Narco 890/891 | 2 of 5 parallel DME tuning, compatible with the following Narco DME units:<br>*DME 890*<br>*DME 891* |

#### 6.4.2.3.2 A429

**Table 6-10. A429 Settings**

| Selection | Description |
|---|---|
| Directed Freq 1 | If the GNC is connected to a multi-channel ARINC 429 DME, channel 1 of that DME is tuned. “Direct Freq 1” should be selected if a single-channel ARINC 429 DME is to be tuned. |
| Directed Freq 2 | If the GNC is connected to a multi-channel ARINC 429 DME, channel 2 of that DME is tuned. |

### 6.4.2.4 NAV Info

The NAV Info page (Figure 6-12) allows the installer to view and verify the NAV board software version, software part number, and hardware version.

**Figure 6-12. NAV Information Page**

### 6.4.2.5 NAV Update

**NOTE**

*Garmin recommends the use of a USB 2.0 compatible USB flash drive for updating databases and software on the GTR/GNC.*

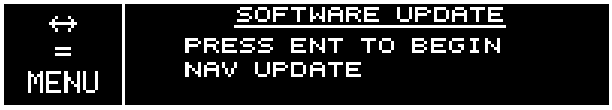


**Figure 6-13. NAV Software Update Page**

Refer to Section 6.8 for instructions on loading software to the GTR/GNC.

## 6.4.3 COM Configuration

### 6.4.3.1 MIC Gain

The MIC Gain page (Figure 6-14) allows the installer to set the MIC gains for MIC 1 and MIC 2. The MIC 1 and MIC 2 gain can be adjusted from -12 dB to +30 dB in 6 dB increments. The default is +12 dB. For MICs with low signal levels, this can be adjusted up to increase the signal strength. For MICs with high signal levels, this can be adjusted down to decrease the signal strength. Note that the MIC 2 gain setting is dependent upon the MIC 1 gain setting.

**Figure 6-14. MIC Gain Page**

### 6.4.3.2 COM RX Squelch

The COM RX squelch page (Figure 6-15) allows the installer to configure the squelch for the COM receiver. The COM RX squelch adjusts the signal strength required to break squelch for the COM receiver. The COM RX squelch is adjustable in the range of 0 (zero) to 100. The default value is zero. Decreasing the value will allow squelch to be broken with low signal levels. Increasing the value will require higher signal levels to break squelch.

**Figure 6-15. COM RX Squelch Page**

### 6.4.3.3 COM Info

The COM information page (Figure 6-16) allows the installer to view and verify the COM board software version, software part number, hardware version, boot version, boot P/N, FPGA version, and FPGA P/N.

**Figure 6-16. COM Information Page**

### 6.4.3.4 COM Update

**NOTE**

*Garmin recommends the use of a USB 2.0 compatible USB flash drive for updating databases and software on the GTR/GNC.*

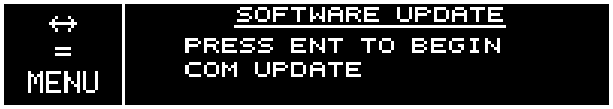


**Figure 6-17. COM Software Update Page**

Refer to Section 6.8 for instructions on loading COM software to the GTR/GNC.

### 6.4.4 Audio Configuration

#### 6.4.4.1 COM Sidetone

The COM Sidetone page (Figure 6-18) allows the installer to adjust the COM sidetone volume. COM sidetone is the audio spoken into the COM microphone. This setting only affects the volume of the sidetone for the GTR/GNC COM during PTT. To adjust the COM sidetone volume, rotate the smaller inner knob to the desired value. This field is adjustable in the range of 0 (zero) to 100. The default is 50.

**Figure 6-18. COM Sidetone Page**

#### 6.4.4.2 Mix NAV Audio

The Mix NAV Audio page (Figure 6-19) allows the installer to configure whether NAV audio is mixed with the COM headphones. With this option set to 'On', the NAV audio will be sent along with COM audio to the pilot's headphones and the audio will be 'mixed'. With this option set to 'Off', the NAV audio will not be heard in the pilot's headphones. The NAV audio will still be sent over the analog audio lines on P2002-16 and 17. In installations with an audio panel, this should be set to 'Off'. Use the smaller inner knob to select On or Off. Press **ENT** when the appropriate selection is displayed.

**Figure 6-19. Mix NAV Audio Page**

#### 6.4.4.3 Hi-Fidelity Audio

The Hi-Fidelity Audio page (Figure 6-20) allows the installer to enable or disable the hi-fidelity Aux audio input on the GTR/GNC. If a music audio source is connected to P2001-3 and 19, it may be desirable to enable the Hi-Fidelity audio. Use the smaller inner knob to select On or Off. Press **ENT** when the appropriate selection is displayed.

**Figure 6-20. Hi-Fidelity Audio Page**

### 6.4.5 Log Functions

#### 6.4.5.1 Download Log

**NOTE**

*Garmin recommends the use of a USB 2.0 compatible USB flash drive for updating databases and software on the GTR/GNC.*

The Download Log page (Figure 6-21) is where the GTR/GNC keeps an error log to aid in diagnostics and troubleshooting. The error log can be downloaded to a zip drive attached to the USB port on the GTR/GNC. To download the error log, insert the USB dongle cable into the GTR/GNC USB port and attach a USB flash drive to the dongle. Then select the Download Log page. When ready, press the **ENT** key to download the error log to the USB flash drive.

**Figure 6-21. Download Log Page**

#### 6.4.5.2 Clear Error Log

The Clear Error Logs page (Figure 6-22) allows the installer to clear the internal error log on the GTR/GNC. It can be cleared by selecting the Clear Error Log page with the smaller inner knob and then pressing the **ENT** key. Press **ENT** again to clear the stored error logs. This will delete all stored error logs on the GTR/GNC.

**Figure 6-22. Clear Error Logs Page**

## 6.5 Ground Checks (Configuration Mode)

The following checks are performed in configuration mode. To enter configuration mode, remove power from the GTR/GNC. With the GTR/GNC turned off, press and hold the **ENT** key and apply power to the GTR/GNC by turning the COM volume knob clockwise. Release the **ENT** key when the display activates and 'Garmin' appears on the screen.

### 6.5.1 Calibrate Resolver (GNC Only)

After selecting 'Resolver' as the indicator head on the CDI Indicator page (Figure 6-10) of the NAV group, it is necessary to calibrate the interface between the GNC and the resolver. The accuracy of the system is dependent on this calibration. The GNC cannot drive multiple resolvers at the same time. It is not recommended that external resolvers be switched through a relay or other means because the resolver must be calibrated to the radio as described in this procedure. If multiple resolvers are desired in the installation, the primary unit must be installed and calibrated as described here. The secondary unit should use the composite output.

1. After selecting Resolver as the indicator head type, select 'Cal Resolver' to calibrate the OBS resolver.
2. Press **ENT**.
3. Follow the directions on the GNC display.

**Figure 6-23. Calibrate OBS Resolver Page**

4. At the end of setup, press **ENT** to store results.
5. Tune to any VOR frequency.
6. Press the **OBS** key.
7. Verify that the OBS decoded properly from 0 to 360 degrees.

If the GNC will not accept the calibration, there may be a problem with the resolver interface. Verify wiring and contact Garmin for assistance if necessary.

### 6.5.2 Flags Check (GNC Only)

The Flags test sends an active signal for each selected flag so you can test the interface to the connected devices directly from the front panel while you are on the ground. The Flag tests include NAV (NAV), GS (Glideslope), and T/F (To/From). The Test Analog Flag page (Figure 6-24) can be found in the NAV group (Figure 6-1).

**NOTE**

*Some CDIs/HSIs require that the ILS ENERGIZE discrete be active for flags check and CDI/VDI check to function properly.*

**Figure 6-24. Test Analog Flags Page**

1. Select the Test Analog Flags page. Press **ENT**.
2. Turn the large outer knob to change the flag selection. Turn the small knob to select valid or invalid. Check the connected indicator for the appropriate flag.
3. Turn the large knob to the next flag type and turn the small knob to change it to valid or invalid. You can only select From, To, or Hidden as active, not at the same time.
4. Ensure the flags on the connected indicator function as intended.

### 6.5.3 VOR/Localizer/Glideslope Indicator (GNC Only)

The Test CDI/VDI page (Figure 6-25) of the NAV group, allows the analog indicator connected to the GNC to be checked for proper wiring and operation.

**Figure 6-25. Test CDI/VDI Page**

If the GNC is interfaced to an analog indicator, perform the following steps:

1. Select the Test Analog CDI/VDI page and press **ENT**. Rotate the larger outer knob to select between CDI and VDI.
2. On the CDI selection, verify correct operation of the lateral deviations on the indicator by using the corresponding selections (Max Left, Full Left, Centered, Full Right, Max Right).
3. On the VDI selection, verify correct operation of the vertical deviations on the indicator by using the corresponding selections (Max Up, Full Up, Centered, Full Down, Max Down).

### 6.5.4 Lighting Bus Interface Check

**CAUTION**

*When 14 VDC or 28 VDC lighting buses are connected to the GTR/GNC, connection of the aircraft lighting bus to the incorrect input pins can cause damage to the GTR/GNC. Always start this test with the dimming bus at the lowest setting, and slowly increase the brightness. If the brightness level on the GTR/GNC display does not increase as the lighting is increased in brightness, verify that the wiring is correct before proceeding.*

The display and bezel key backlighting on the GTR/GNC can track an external lighting/dimmer bus input and use it to vary the display and bezel key backlight levels accordingly. This check verifies that the interface is connected correctly.

1. Ensure the lighting bus is set to its minimum setting.
2. Slowly vary the lighting bus level that is connected to the GTR/GNC. Verify that the display brightness tracks the lighting bus setting. Continue to maximum brightness and verify proper operation.

## 6.6 Ground Checks (Normal Mode)

### 6.6.1 Discrete Input Checkout

**Table 6-11. Discrete Input Pins**

| Pin | Pin Name | Description |
|---|---|---|
| P2001-12 | INTERCOM ENABLE* | Enables the intercom function on the GTR/GNC. |
| P2001-27 | COM REMOTE TRANSFER* | Flip-flops the active and standby COM frequencies. |
| P2001-28 | COM REMOTE TUNE UP* | Scrolls up through the preset COM frequencies in the standby frequency field. |
| P2001-29 | COM REMOTE TUNE DOWN* | Scrolls down through the preset COM frequencies in the standby frequency field. |
| P2002-28 | VLOCK REMOTE TRANSFER | Flip-flops the active and standby NAV frequencies. |

If a switch is connected to any pins listed in Table 6-11, perform the following procedure:

1. For each of the switches that are connected, exercise the switch source.
2. Verify that the function controlled by the switch operates as intended.
3. If the switch is exercised and does not cause the GTR/GNC to operate as intended, verify the wiring between the GTR/GNC and the switch.

### 6.6.2 VHF NAV Checkout

Check the VOR reception with ground equipment, operating VOT or VOR, and verify audio and Morse code ID functions (if possible). Tune a localizer frequency and verify the CDI needle, NAV flag, VDI needle and GS flag operation.

### 6.6.3 NAV Audio Check (Audio Panel Installations) (GNC Only)

1. Ensure the audio panel is powered on, and perform the following steps:
2. Plug in a headset at pilot and copilot position.
3. Tune the GNC NAV receiver to a local VOR station, and select NAV audio on the audio panel.
4. Ensure the Morse code identifier is being received over the crew headsets.
5. If the audio is not heard, verify the wiring connections to the audio panel.
6. Ensure the audio volume is sufficient for all anticipated cockpit noise conditions.

### 6.6.4 VHF COM

#### 6.6.4.1 Antenna Check

If desired, the antenna VSWR can be checked using an inline wattmeter in the antenna coaxial using frequencies near both ends of the band. The VSWR should be less than 2:1. A VSWR of 2:1 will cause a drop in output power of approximately 12%.

#### 6.6.4.2 Receiver/Transmitter Check

Tune the unit to a local VHF frequency and verify the receiver output produces a clear and understandable audio output. Verify the transmitter functions properly by contacting another station and getting a report of reliable communications.

#### 6.6.4.3 Aux Audio Input Check

This check is only required for installations with an aux audio source connected to pins P2001-3 and -19.

1. Connect an audio source to the Aux Audio input (P2001-3 and -19).
2. Verify that AUX audio is heard over the pilot headset position.

#### 6.6.4.4 Database Check

Check the Frequency Database to ensure it is current. The database information is displayed during the unit display start-up sequence. To check the database:

1. Cycle power on the GTR/GNC. The Unit will go through its normal start-up sequence.
2. Press FUNC and select SYS configuration with the larger outer knob. Rotate the smaller inner knob to select DATABASE INFO, and press the ENT button.
3. Verify that the effectivity (EFCTV) date has not passed for the frequency database.

#### 6.6.4.5 RS-232 Serial Interface Checks

The interfaces to RS-232 equipment such as the GTN 6XX/7XX or GNS 400W/500W series GPS sources should be checked as follows:

1. Operate the connected GPS source and the GTR/GNC in normal mode. Ensure the aircraft has a clear view of the sky for this check. This check should not be performed in a hangar.
2. Ensure the connected GPS source has a valid GPS satellite fix.
3. Press the FUNC button and rotate the smaller inner knob to the Nearest Airport menu.
4. Verify that ‘NO GPS’ is not displayed on the screen. If the GTR/GNC displays ‘NO GPS’, verify the wiring between the GPS source and the GTR/GNC.

The interfaces to RS-232 equipment such as the G500/G600 or other serial interface should be checked as follows:

1. Operate the connected serial remote tune source and the GTR/GNC in normal mode.
2. Ensure that the remote source is able to display data from the GTR/GNC.

### 6.6.5 Interface Checkout

This section describes the checks that must be carried out to verify that systems interfacing to the GTR/GNC are communicating properly. Only those interfaces that are connected to the GTR/GNC must be verified.

#### 6.6.5.1 External RMI/OBI Interface Check (GNC Only)

If the VOR OBI output from the GNC is connected to an RMI navigation indicator verify the interface as described in this section. If the following steps do not perform correctly, check the electrical connections and configuration setup. The aircraft heading system must be operating properly in order for the RMI needle to point correctly.

1. Apply power to the equipment.
2. If installed, set the RMI select switch to the VLOC position.
3. Tune a local VOR station, or use a simulated signal from an approved VOR Test System.
4. Verify that the RMI needle swings and points toward the VOR station.

#### 6.6.5.2 DME Tuning Check (GNC Only)

1. If the GNC is set up to remotely channel a DME, verify the interface as described in this section.
2. Select a VOR/ILS channel that corresponds to (1) a DME station within a 40 nautical mile range, or (2) the frequency of a DME ground tester.
3. Verify that the DME locks on to the signal and a valid distance is displayed.
4. Tune an invalid VOR station. Verify that the DME data is flagged.

## 6.7 Flight Checks

### 6.7.1 COM Flight Check

After the installation is complete, a flight check is required to ensure satisfactory performance. To check the communications transceiver, maintain an appropriate altitude and contact a ground station facility at a range of at least 50 nautical miles. Contact a ground station in close proximity. Press the COM volume knob to select manual squelch and listen for any unusual electrical noise, which would increase the squelch threshold. If possible, verify the communications capability on both the high, low, and mid bands of the VHF COM band. It may be required by the governing regulatory agency to verify operation of the COM transmitter and receiver at the extents of a ground facility's service volume (e.g. FAA AC 23-8A).

### 6.7.2 VOR Flight Check (GNC Only)

1. Tune a local VOR station within 50 miles.
2. Verify the audio IDENT and voice quality and verify that no objectionable electrical interference such as magneto noise is present.
3. Verify the Morse code decoder IDs the station (95% probability).
4. Fly to and from the station.
5. Verify NAV flag, TO/FROM flag, and CDI are operational.

It may be required by the governing regulatory agency to verify operation of the VOR receiver at the extents of a ground facility's service volume (e.g. FAA AC 23-8A).

### 6.7.3 ILS Flight Check (GNC Only)

1. Tune an ILS at a local airport.
2. Verify the audio IDENT and audio quality and verify that no objectionable electrical interference such as magneto noise is present.
3. Verify the Morse code decoder IDs the station (95% probability).
4. Fly the approach.
5. Verify NAV flag, GS flag, and CDI and VDI are operational.

## 6.8 Software Loading

The GTR/GNC comes pre-loaded with software. However, if the software is out of date, it is recommended that current software from a USB 2.0 zip drive be loaded into the GTR/GNC. For dual GTR/GNC installations, the software loading procedures must be carried out on both units.

### 6.8.1 Creating a GTR/GNC Software Loader USB Flash Drive

**NOTE**

*Note: The application to create a loader card requires Windows 2000, XP, Vista, or Windows 7. There is no Mac support at this time.*

1. Go to the Dealer Resource Center on Garmin's web site.
2. Download the GTR/GNC System software to your PC.
3. Ensure that you have a USB 2.0 compatible USB drive connected to the PC in the USB slot.
4. Run the executable file that was downloaded and follow the prompts on the screen to create the software loader USB drive.
5. After the card has been created, select finish to complete the process.
6. Remove the USB drive from the slot. The GTR/GNC USB loader drive is now ready to use.

### 6.8.2 Loading Software to the GTR/GNC

To load software to the GTR/GNC, ensure that the unit is powered on in the configuration mode.

1. Connect the provided USB adapter to the USB slot on the GTR/GNC. Insert the software loaded USB flash drive into the other end of the cable, as shown in Figure 6-26.

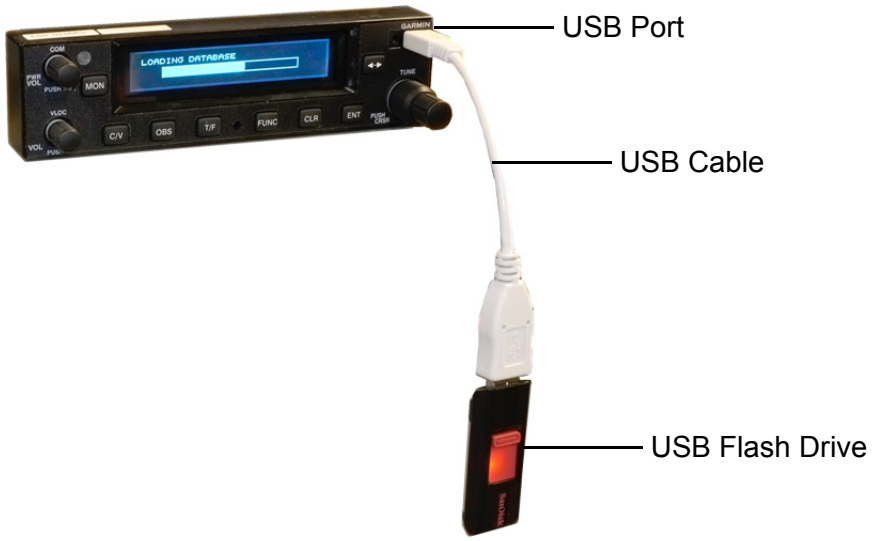


**Figure 6-26. USB Update Progress**

2. From the configuration mode home page, press ENT to access the SYS Configuration page. Turn the small inner knob clockwise until the software update page is displayed. Press ENT to begin the software update.
3. Verify that the available GTR/GNC software updates are being displayed.
4. Press the ENT key to begin the software update. When the updates are finished, the GTR/GNC will display the updates.
5. Verify the software updates loaded successfully.

### 6.8.3 Load Database

1. Insert the supplied cable into the USB port on the top right corner of the GTR/GNC.
2. Insert the USB memory device into the other end of the cable.
3. Press FUNC to access the Functions. Turn the LARGE knob to select the SYS function. Turn the SMALL knob to view the Load Database function. Then, press the ENT key.

**Figure 6-27. Database Update Display**

4. Verify the database version on USB. Then, press the ENT key. Updating will begin automatically.

**Figure 6-28. Verify Database Version**

## 6.9 Documentation Checks

### 6.9.1 Airplane Flight Manual Supplement

Ensure that the Airplane Flight Manual Supplement (AFMS) is inserted in the Airplane Flight Manual (AFM) or Pilot's Operating Handbook (POH).

# 7 PERIODIC MAINTENANCE

## 7.1 Equipment Calibration

No scheduled servicing tasks are required on the GTR/GNC.

## 7.2 VOR Checks

Refer to CFR 14 paragraph 91.171. Every 30 days verify the limits of the permissible indicated bearing error.

## 7.3 Cleaning

The front bezel, keypad, and display can be cleaned with a microfiber cloth or with a soft cotton cloth dampened with clean water. DO NOT use any chemical cleaning agents. Care should be taken to avoid scratching the surface of the display.

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# APPENDIX A ENVIRONMENTAL QUALIFICATION FORM

For RTCA/DO-160F Environmental Qualification Forms (EQFs) visit the Dealer Resource Center on Garmin's web site.

The EQF part number for the GTR Series (GTR 225/225A/225B) is 005-00658-02.

The EQF part number for the GNC Series (GNC 255A/255B) is 005-00658-03.

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# APPENDIX B GTR/GNC DATA FORMAT

## B.1 RS-232 Aviation Data Format

### B.1.1 Electrical Interface

The I/O signals are compatible with RS-232C. Data is generated at 9600 baud with a word length of 8 bits, one stop bit, and no parity.

### B.1.2 General Aviation Output Format

The GTR/GNC RS-232 data has the following general format:

STX - ASCII start-of-text character (02 hex)
t1s - Type 1 output sentences (see following paragraphs for description)
t2s - One or more type 2 output sentences (see following paragraphs for description)
ETX - ASCII end-of-text character (03 hex)

### B.1.3 Aviation Output Sentence Type 1

The Type 1 output sentences have the following general format:

id - item designator (single ASCII alphabetic character)
dddd - item data (1 to 10 printable ASCII characters)
CR - ASCII carriage return character (0D hex)
LF - ASCII line feed character (0A hex)*

Each Type 1 sentence is output by the GTR/GNC approximately once every second.

The track, desired track, and bearing to waypoint angles, and the magnetic variation are output according to the current mode of the GTR/GNC (automatic magnetic heading, magnetic variation computed at last known position; true heading, magnetic variation of E00.0°; or user-defined magnetic heading, magnetic variation as entered by user).

Table B-1 describes the Type 1 output sentence item designator (id) and item data (dddd) fields. If data for these sentences is invalid or unavailable, dashes ("-") are used to fill in all non-blank character positions.

**Table B-1. Aviation Output Sentence Format**

| Ident (1 byte) | Data (10 bytes)<br>1 2 3 4 5 6 7 8 9 0 | Description |
|---|---|---|
| z | a a a a a | Current GPS altitude in feet * |
| A | s d d m m h h | Current latitude, where:<br>s - N (north) or S (south)<br>dd - degrees<br>mm - minutes<br>hh - hundredths of minutes |
| B | s d d d m m h h | Current longitude, where:<br>s - E (east) or W (west)<br>ddd - degrees<br>mm - minutes<br>hh - hundredths of minutes |
| C | d d d | Track in whole degrees |
| D | s s s | Ground speed in knots |
| E | d d d d d | Distance to waypoint in tenths of nautical miles |
| G | s n n n n | Cross track error, where:<br>s - L (left) or R (right) of course<br>nnnn - error in hundredths of nautical miles |
| I | d d d d | Desired track in tenths of degrees |
| K | c c c c c | Destination waypoint identifier (will be blank filled on right if less than 5 characters in identifier) |
| L | d d d d | Bearing to destination waypoint in tenths of degrees |
| Q | s d d d | Magnetic variation, where:<br>s - E (east) or W (west)<br>ddd - tenths of degrees |
| S | - - - - f | NAV valid flag status, where:<br>f - N (NAV flagged) or - (NAV valid) |
| T | - - - - - - - - - - | Warnings status, only data transmitted are dashes (-). Used to indicate end of Type 1 sentences. |
| l (lower case Lima) | d d d d d d | Distance to destination waypoint in tenths of nautical miles. |

* The altitude is not output if the RS-232 port is configured as “Aviation Output 2.”

* The line feed character is not output if the RS-232 port is configured as “Aviation Output 2.”

### B.1.4 Aviation Output Sentence Type 2

The GTR/GNC Type 2 aviation output sentence has the following general format:

| | |
|---|---|
| id | - item designator (3 ASCII characters) |
| seq | - sequence number (1 binary byte) |
| wpt | - waypoint identifier (5 ASCII characters) |
| lat | - waypoint latitude (3 binary bytes) |
| lon | - waypoint longitude (4 binary bytes) |
| mvar | - magnetic variation at waypoint (2 binary bytes) |
| CR | - ASCII carriage return character (0D hex) |
| LF | - ASCII line feed character (0A hex) |

Each waypoint in the route being navigated by the interfacing equipment has a Type 2 sentence output by the interfacing navigation equipment approximately once every second.

If no route is being navigated by the interfacing navigation equipment (i.e., the active route is empty), the following Type 2 sentence is output approximately once every second:

| | |
|---|---|
| id | - item designator (3 ASCII characters; route sequence number is "01") |
| seq | - sequence number (1 binary byte; last waypoint flag is set; route sequence number is 1) |
| CR | - ASCII carriage return character (0D hex) |
| LF | - ASCII line feed character (0A hex) |

Table B-2 describes the Type 2 aviation output sentence item designator (id), sequence number (seq), waypoint identifier (wpt), waypoint latitude (lat), waypoint longitude (lon), and magnetic variation at waypoint (mvar) fields.

**Table B-2. Type 2 Aviation Output Sentence Format**

| Field | Byte | Format<br>7 6 5 4 3 2 1 0 | Description |
|---|---|---|---|
| id | 1<br>2-3 | | ASCII character 'w' (77 hex)<br>Two ASCII numeric characters representing route sequence number of waypoint (01 to 31) |
| seq | 1 | x l a n n n n n | x - undefined<br>l - 1 if last waypoint in route<br>a - 1 if active to waypoint<br>nnnnn - route sequence number of waypoint (unsigned binary) |
| wpt | 1-5 | | Destination waypoint identifier (will be blank filled on right if less than 5 characters in identifier) |
| lat | 1<br>2<br>3 | s d d d d d d d<br>x x m m m m m m<br>x h h h h h h h | s - 0 (north) or 1 (south)<br>ddddddd - latitude degrees (unsigned binary)<br>xx - undefined<br>mmmmmm- latitude minutes (unsigned binary)<br>x - undefined<br>hhhhhhh - hundredths of latitude minutes (unsigned binary) |
| lon | 1<br>2<br>3<br>4 | s x x x x x x x<br>d d d d d d d d<br>x x m m m m m m<br>x h h h h h h h | s - 0 (east) or 1 (west)<br>xxxxxxx - undefined<br>dddddddd - longitude degrees (unsigned binary)<br>xx - undefined<br>mmmmmm- latitude minutes (unsigned binary)<br>x - undefined<br>hhhhhhh - hundredths of latitude minutes (unsigned binary) |
| mvar | 1-2 | | Two's complement binary in 16ths of degrees. Easterly variation is positive. MSB output first. |

## B.2 RS-232 NMEA Data Format

### B.2.1 Electrical Interface

The I/O signals are compatible with RS-232C. Data is generated at 9600 baud with a word length of 8 bits, one stop bit, and no parity.

The data format for the serial communication is:

| | |
|---|---|
| Baud rate | 9600 |
| Data bits | 8 |
| Stop bits | 1 |
| Parity | None |

### B.2.2 Message Formats

All messages conform to the NMEA 0183 proprietary message format as follows. All characters will be standard ASCII characters. No binary data characters are used.

"$" .....Start of message character, ASCII "$" (024h).

"P" .....Proprietary message identifier.

"GRM" .....Garmin company identifier.

c.....Message class identifier; Identifies a message as either a COMM or NAV message. The GTR and COM portion of the GNC use "C", while message for the NAV portion of the GNC use "V".

nn .....Message identifier, two-digit number in ASCII characters.

d.....d .....Message data characters defined for each message.

chksum .....Message checksum, including message identifier (nn) through data characters (d…..d). The two-digit checksum is generated by adding all values of valid characters together, ignoring carry (if any). This value is converted into two encoded hex[1] characters (30h-3Fh).

<CR> .....ASCII carriage return (0Dh).

<LF> .....ASCII line feed (0Ah).

The maximum message length, including the start of message character ("$") and the end of message <CR><LF> sequence, is 25 bytes.

1. Encoded hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters "5" and "?", respectively.

### B.2.3 Message Output Rate

The GTR/GNC will output the following messages at the specified rates:

- CDI, VDI, and Flags at 10Hz (high rate).
- Decoded OBS Setting at 10Hz (high rate).
- Radial from Active VOR at 10Hz (high rate).
- Decoded Station Identifier at 1Hz (low rate).
- NAV Receiver Status at 1Hz (low rate).
- COM Transceiver Status at 1Hz (low rate).

### B.2.4 Message Definitions

#### B.2.4.1 Input Messages

##### B.2.4.1.1 Request Data Output

This input command is used to request an output message to be sent by the GTR/GNC. Message data may be specified. There are a few important things to keep in mind:

- The GTR/GNC will flag the specified message for output when it receives the request. There will be a lag between the time the message is flagged for output and the time it is actually output. If another request for the same message is received in this period, then the previous request will be lost. The amount of lag depends on the number of messages that are consecutively flagged for output.
- Use of unsupported output identifiers will not generate a Communication Error message.

**Message format (GNC NAV requests):**

"V" .....Message class. This is a GNC NAV request.

"24" .....Message identifier.

ii .....Output identifier of requested message, two ASCII characters. 29 = Request NAV Audio. 40 = Request NAV Volume. 41 = Request GNC Status.

"000" .....Reserved.

**Message format (GTR/GNC COM requests):**

"C" .....Message class. This is a GTR/GNC COM request.

"06" .....Message identifier.

ii .....Output identifier of requested message, two ASCII characters. 02 = Request COM Audio Volume. 03 = Request COM software version. 13 = Request GTR Status.

d .....Message sub-id; set to (ASCII) 1 for Request COM Audio Volume, 0 otherwise.

"00" .....Reserved.

**Example messages:**

$PGRMV2429000<chksm><CR><LF>

Request the GNC to send the current NAV Audio configuration.

$PGRMC0613000<chksm><CR><LF>

Request the GTR/GNC to send the current COM status.

#### B.2.4.1.2 Set Active COMM Frequency and Transceiver Function.

This message is used to set the Active COM frequency as well as the COM transceiver function.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"00".....Message identifier.

mk .....Active COMM frequency:

m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 118 to 136 MHz.

k = desired frequency in KHz, where k = (desired frequency / 25 KHz) + 30h, with desired frequency in range of 000 to 975 KHz in 25 KHz steps.

a.....Transceiver function: N = normal, M = monitor, 0 = unchanged.

o .....8.33 KHz offset: (ASCII) 0 = 25 KHz frequency (.000); 1 = first 8.33 KHz channel offset (.005); 2 = second 8.33 KHz channel offset (.010); 3 = third 8.33 KHz channel offset (.015)

**Example message:**

$PGRMC00G4N0<chksm><CR><LF>

This example command would set the active COM frequency to 119.100 MHz and place the COMM radio in Normal receive mode. This is interpreted by noting that the ASCII 'G' corresponds with 47h, +30h = 77h, converted to decimal equals 119 for the MHz portion. The KHz portion converts ASCII '4' to 34h, -30h yields 4h, x25KHz steps = 100 KHz, with no 8.33 KHz channel offsets.

**Note:** The GTR/GNC will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid, or an 8.33 KHz frequency is requested when the GTR/GNC is in 25 KHz channel spacing mode.

**Note:** The GTR/GNC will ignore this message while transmitting on the active COM frequency.

#### B.2.4.1.3 Set Standby COM Frequency and Transceiver Function.

This message is used to set the standby COM frequency as well as the COM transceiver function.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"01".....Message identifier.

mk .....Standby COMM frequency:

m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 118 to 136MHz.

k = desired frequency in KHz, where k = (desired frequency / 25 KHz) + 30h, with desired frequency in range of 000 to 975KHz in 25KHz steps.

a.....Transceiver function: N = normal, M = monitor, 0 = unchanged.

o .....8.33 KHz offset: (ASCII) 0 = 25 KHz frequency (.000); 1 = first 8.33 KHz channel offset (.005); 2 = second 8.33 KHz channel offset (.010); 3 = third 8.33 KHz channel offset (.015)

**Example messages:**

$PGRMC01KFM2<chksm><CR><LF>

This example command would set the standby COM frequency to 123.565MHz and place the COMM radio in Monitor mode. This is interpreted by noting that the ASCII 'G' corresponds with 47h, +30h = 77h, converted to decimal equals 119 for the MHz portion. The KHz portion converts ASCII 'F' to 46h, -30h yields 16h, x25KHz steps = 550KHz , add 3 8.33 channels = 565KHz.

**Note:** The GTR/GNC will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid, or an 8.33 KHz frequency is requested when the GTR/GNC is in 25 KHz channel spacing mode.

#### B.2.4.1.4 Set COM Volume Level and Audio Control Parameters

This input is used to set the volume level for the headphone output, and various audio controls parameters.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"02".....Message ident.

n .....Data type: (ASCII) 1 = headphone, 4 = sidetone level, 9 = RF squelch

vv .....Volume level: 00-FFh; two encoded hex characters (30h-3Fh).

**Example message:**

$PGRMC0211=<chksm><CR><LF>

Set the speaker output volume to 1Dh out of FFh ("=" = 3Dh, -30h = Dh).

#### B.2.4.1.5 Select Squelch Override

This input is used to turn the manual squelch on and off.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"03" .....Message ident.

n .....Squelch test: (ASCII) 0 = automatic; 1 = manual override (displays "SQ").

**Example message:**

$PGRMC030<chksm><CR><LF>

Set the squelch to normal operation.

#### B.2.4.1.6 Set COM Channel Spacing

This input is used to adjust the configured channel spacing for COM frequencies.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"13" .....Message ident.

ss .....New spacing: (ASCII) 83 = 8.33 KHz spacing; 25 = 25 KHz spacing.

**Example message:**

$PGRMC183<chksm><CR><LF>

Set channel spacing to 25 KHz.

#### B.2.4.1.7 Set Active NAV Frequency

This message is used to set the active NAV frequency.

**Message format:**

"V" .....Message class. This is a GNC NAV message.

"27" .....Message identifier.

mk .....Active VOR/LOC frequency:

m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 108 to 117MHz.

k = desired frequency in KHz, where k = (desired frequency / 25KHz) + 30h, with desired frequency in range of 000 to 950KHz in 50KHz steps, or the even numbers from 30h to 56h.

"0" .....Reserved, data in this field will be ignored.

**Example message:**

$PGRMV27E40<chksm><CR><LF>

This example command would set the active VOR frequency to 117.100MHz. This can be interpreted by noting that the ASCII 'E' corresponds with 45h, +30h = 75h, converted to decimal equals 117 for the MHz portion of the command. The KHz portion converts ASCII '4' to 34h, -30h = 4h, x 25KHz steps = 100KHz.

**Note:** The GNC will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

#### B.2.4.1.8 Set Standby NAV Frequency

This message is used to set the standby NAV

**Message format:**

"V" .....Message class. This is a GNC NAV message.

"28" .....Message identifier.

mk .....Standby VOR/LOC frequency:

m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 108 to 117MHz.

k = desired frequency in KHz, where k = (desired frequency / 25KHz) + 30h, with desired frequency in range of 000 to 975KHz in 50KHz steps, or the even numbers from 30h to 56h.

"0" .....Reserved, data in this field will be ignored.

**Example message:**

$PGRMV28?P0<chksm><CR><LF>

This example command would set the standby VOR frequency to 111.800MHz. This is interpreted by noting that the ASCII '?' corresponds with 3Fh, +30h = 6Fh, converted to decimal equals 111 for the MHz portion. The KHz portion converts ASCII 'P' to 50h, -30h yields 20h, x 25KHz steps = 800KHz.

**Note:** The GNC will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

#### B.2.4.1.9 Set NAV Audio Mode

This message is used to change the current NAV audio mode. There are two possible settings for this mode. The first is "IDENT", which will suppress the voice portion of the NAV audio signal and emphasize the Morse Code station identifier. The second choice is "VOICE", which will emphasize voice signal and suppress the Morse Code station identifier (unit will display "ID" in the upper-left corner of the NAV page).

This message is available in both normal and test modes.

**Message format:**

"V" .....Message class. This is a VHF NAV message.

"31" .....Message identifier.

a.....NAV audio mode. "I" = IDENT, "V" = VOICE

**Example message:**

$PGRMV31I<chksm><CR><LF>

Set the current NAV Audio mode to IDENT.

#### B.2.4.1.10 Set Omni-Bearing Select (OBS) Value.

This message is used to set the OBS value used by the GNC as the selected radial for computing the course deviation from a VOR. This message will have no effect unless the GNC is configured to use the serial port as its OBS source ("NONE" or "SERIAL").

**Message format:**

"V" .....Message class. This is a VHF NAV message.

"34" .....Message identifier.

vvv .....OBS Value in degrees, ranging from "000" to "359".

**Example message:**

$PGRMV34310<chksm><CR><LF>

Set the OBS value to 310 degrees.

#### B.2.4.1.11 Set NAV Volume Level

This input is used to set the volume level for the NAV mixed audio.

**Message format:**

"V" .....Message class. This is a GNC NAV message.

"43" .....Message ident.

vv .....Volume level: 00-FFh; two encoded hex characters (30h-3Fh).

**Example message:**

$PGRMV431=<chksm><CR><LF>

Set the NAV volume to 1Dh out of FFh ("=" = 3Dh, -30h = Dh).

### B.2.4.2 Output Messages

#### B.2.4.2.1 COM Transceiver Status

This message is used to output the current status of the GTR/GNC COM. It will be output at the configured message rate (1 Hz) or whenever the status changes.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

"01".....Message identifier.

mk .....Active frequency: m = MHz, where m = desired MHz frequency - 30h, ranging from 118 to 136 MHz, (i.e. 76h to 88h, A2h); k = (KHz offset / 25KHz) + 30h, ranging from 000 to 975KHz in 25 KHz steps.

mk .....Standby frequency: m = MHz, where m = desired MHz frequency - 30h, ranging from 118 to 136 MHz, (i.e. 76h to 88h, A2h); k = (KHz offset / 25KHz) + 30h, ranging from 000 to 975KHz in 25 KHz steps.

a.....Transceiver status:

I = Intercom (no other status applicable)
R = Normal receive
M = Monitor receive
T = Transmit active
S = Stuck mic
F = Comm failure

s.....Squelch setting: (ASCII) 0 = automatic; 1 = manual override ("SQ" shown in upper-left corner of COM active frequency.)

hh .....COM channel spacing: (ASCII) 25 = 25 KHz mode; 83 = 8.33 KHz mode.

o .....Active frequency 8.33 KHz offset: (ASCII) 0 = 25 KHz frequency (.000); 1 = first 8.33 KHz channel offset (.005); 2 = second 8.33 KHz channel offset (.010); 3 = third 8.33 KHz channel offset (.015).

o .....Standby frequency 8.33 KHz offset: (ASCII) 0 = 25 KHz frequency (.000); 1 = first 8.33 KHz channel offset (.005); 2 = second 8.33 KHz channel offset (.010); 3 = third 8.33 KHz channel offset (.015)

**Example message:**

$PGRMC01G4LFR08303<chksm><CR><LF>

Active frequency is 119.100MHz, the standby frequency is 124.565MHz, unit is receiving, squelch is automatic, and the unit is in 8.33 KHz mode.

**Note:** This message is output at a nominal one second rate, or faster whenever the transceiver function or status changes.

#### B.2.4.2.2 COM Volume Level

This message is used to output the COM volume level.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

02 .....Message ident.

"1".....Headphone Volume.

vv .....Volume level: 00-FFh; use encoded hex (30h-3Fh).

**Example message:**

$PGRMC02130<chksm><CR><LF>

The headphone volume level is 30h out of FFh.

#### B.2.4.2.3 COM Software Version

This message is used to output the COM module software version.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

03 .....Message ident.

vvvv .....Software version in ASCII.

Example message:

$PGRMC030100<chksm><CR><LF>

COM Software version is 01.00.

#### B.2.4.2.4 GTR/GNC COM Status

This message is used to output the GTR/GNC COM Status.

**Message format:**

"C" .....Message class. This is a GTR/GNC COM message.

13 .....Message identifier

a.....COM needs service; (ASCII) 0 = OK, 1 = COM transmit capabilities not reliable.

b .....COM status; (ASCII) 0 = OK, 1 = COM functions not available.

c.....Push-to-Talk key stuck; (ASCII) 0 = OK, 1 = Stuck.

d .....Remote Transfer stuck; (ASCII) 0 = OK, 1 = Stuck.

e.....Remote Tune Up stuck; (ASCII) 0 = OK, 1 = Stuck.

f.....Remote Tune Down stuck; (ASCII) 0 = OK, 1 = Stuck.

g .....COM TX Power Limited; (ASCII) 0 = OK, 1 = Transmit power limited.

h .....COM locked out; (ASCII) 0 = OK, 1 = Active frequency locked at 121.500 MHz.

**Example message:**

$PGRMC1300100001<chksm><CR><LF>

GTR/GNC is running and ready to accept serial input, Push-to-Talk is stuck on, and COM is locked to 121.500 MHz.

#### B.2.4.2.5 GNC Status

This message is sent to indicate to the host that the GNC is running and ready to accept data on the serial port, along with the current status of alerts. It will be sent once upon startup, when requested by the host, and when an alert's status changes.

This message is only available in normal mode.

**Message format:**

"V" .....Message class. This is a VHF NAV message.

"41" .....Message identifier.

a.....VLOC needs Service; (ASCII) 0 = OK, 1 = Lateral course guidance not reliable.

b .....VLOC Status; (ASCII) 0 = OK, 1 = VLOC and Glide slope course guidance not available.

c.....Glide Slope needs service; (ASCII) 0 = OK, 1 = Vertical course guidance not reliable.

d .....Glide Slope Status; (ASCII) 0 = OK, 1 = Glide slope course guidance not available.

e.....NAV remote transfer stuck; (ASCII) 0 = OK, 1 = stuck.

**Example message:**

$PGRMV4100010<chksm><CR><LF>

GNC is running and ready to accept serial input, and glide slope guidance is unavailable.

#### B.2.4.2.6 CDI, VDI, and Related Flags

This message outputs the current values of the CDI, VDI, and their related flags.

Message format:

"V" .....Message class. This is a GNC NAV message.

"21" .....Message identifier.

cc .....CDI deflection. An eight bit value indicating the amount of deflection of the CDI needle, represented as two encoded hex[1] digits. The CDI deflection is a twos complement signed integer in the range of –120 to 120. –100 indicates full left deflection, 0 indicates no deflection, and 100 indicates full right deflection. +/-120 indicates max left/right deflection.

gg .....VDI deflection. An eight bit value indicating the amount of deflection of the VDI needle, represented as two encoded hexcc CDI deflection. An eight bit value indicating the amount of deflection of the CDI needle, represented as two encoded hex digits. The CDI deflection is a twos complement signed integer in the range of –120 to 120. –100 indicates full left deflection, 0 indicates no deflection, and 100 indicates full right deflection. +/-120 indicates max left/right deflection. digits. The CDI deflection is a twos complement signed integer in the range of –120 to 120. –100 indicates full deflection upwards, 0 indicates no deflection, and 100 indicates full deflection downwards. +/-120 indicates max up/down deflection.

ff.....Flags. Eight bits for HNAV and VNAV related flags, represented as two encoded hex digits.

| | |
|---|---|
| Bit 1 (lsb) | Reserved |
| Bit 2 | Localizer detect (1 = using localizer) |
| Bit 3 | FROM flag (1 = From)[2] |
| Bit 4 | TO flag (1 = To) |
| Bit 5 | GSI superflag (1 = hidden) |
| Bit 6 | GSI valid (1 = valid) |
| Bit 7 | NAV superflag (1 = hidden) |
| Bit 8 (msb) | NAV valid (1 = valid) |

**Example message:**

$PGRMV219<64?:<chksm><CR><LF>

This message indicates a full left CDI deflection (-100), a full up VDI deflection (100), both the GSI and NAV flags/superflags are valid, TO flag set, FROM flag not set, using a localizer.

1. Encoded hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters "5" and "?", respectively.

2. The TO and FROM flag can not both be 1, indicating that they are both valid. They can both be zero, indicating that neither is valid. This situation will occur whenever the receiver determines that it is within the "cone of confusion" directly over a VOR, or when no signal is being received.

#### B.2.4.2.7 Decoded OBS setting

This message outputs the current OBS setting, which may be read from the NAV's internal resolver, the last valid value received over serial, or from user input to the front panel.

**Message format:**

"V" .....Message class. This is a GNC NAV message.

"22" .....Message identifier.

v .....Valid flag. "0" (zero) = OBS invalid/not present, "V" = OBS setting is valid.

ddd .....Three digit OBS setting, in degrees. Values are in the range of "000" to "359".

**Example message:**

$PGRMV22V170<chksm><CR><LF>

A valid OBS setting of 170 degrees.

#### B.2.4.2.8 Radial From Active VOR

This message outputs the current bearing from the active VOR station.

**Message format:**

"V" .....Message class. This is a VHF NAV message.

"23" .....Message identifier.

v .....Valid flag. "0" = bearing not valid, "V" = bearing is valid.

dddf .....Bearing to a resolution of 1/10th of a degree. ddd = three digit bearing in degrees, ranging from "000" to "359". f = 1/10th of a degree.

**Example message:**

$PGRMV23V1654<chksm><CR><LF>

A valid bearing of 165.4 degrees FROM the active VOR station.

#### B.2.4.2.9 Decoded Station Identifier

This message outputs the decoded station identifier received on the NAV voice channel. This message will be output even if the station identifier has not been decoded yet. In this case, the message will be flagged as invalid. Note that the validity of this message does not depend on the current NAV audio mode. The decoding is done automatically regardless of this setting.

**Message format:**

"V" .....Message class. This is a GNC NAV message.

"25" .....Message identifier.

v .....Valid flag. "0" = identifier is not valid, "V" = decoded station identifier is valid.

iiiii .....Decoded station identifier, five characters long. If the decoded identifier is less than five characters in length, then the trailing characters will be filled in with spaces. Identifiers are restricted to using ASCII character 0-9 and A-Z.

**Example message:**

$PGRMV25VISLE<Sp><chksm><CR><LF>

The decoded station identifier is valid and is “ISLE “.

### B.2.4.2.10 Communications Error

This message is used to indicate a communication error.

**Message format (GNC NAV error):**

“V” .....Message class. This is a GNC NAV message.

“27” .....Message identifier.

e.....Error code: (ASCII)

“0” = input message checksum error.
“1” = unknown message.
“2” = error or mismatch in message data.

**Message format (GTR/GNC COM error):**

“C” .....Message class. This is a GTR/GNC COM message.

“05” .....Message identifier.

e.....Error code: (ASCII)

“0” = input message checksum error.
“1” = unknown message.
“2” = error or mismatch in message data.

**Example messages:**

$PGRMV271<chksm><CR><LF>

Received an unknown NAV message.

$PGRMC050<chksm><CR><LF>

Received a COM message with an invalid checksum.

### B.2.4.2.11 NAV Receiver Status

This message is used to output the current status of the NAV receiver. It will be output at the configured rate, and will output faster than the configured rate when the NAV receiver status changes.

**Message format:**

“V” .....Message class. This is a GNC NAV message.

“28” .....Message identifier.

mk .....Active NAV frequency: m = MHz, where m + 30h = desired MHz frequency in the range of 108 to 117MHz.

k = desired frequency in KHz, where k = (desired frequency / 25KHz) + 30h, with desired frequency in range of 000 to 950KHz. Note that valid NAV frequencies only lie on 50KHz boundaries (i.e. 108.00, 108.05, 108.10, etc.).

mk .....Standby NAV frequency: m = MHz, where m + 30h = desired MHz frequency in the range of 108 to 117MHz.

k = desired frequency in KHz, where k = (desired frequency / 25KHz) + 30h, with desired frequency in range of 000 to 950KHz. Note that valid NAV frequencies only lie on 50KHz boundaries (i.e. 108.00, 108.05, 108.10, etc.).

"N" .....Reserved.

**Example message:**

$PGRMV28E4?PN<chksm><CR><LF>

Active NAV frequency is 117.100 MHz, Standby NAV frequency is 111.800 MHz.

#### B.2.4.2.12 NAV Audio Mode

This message is used to output the current NAV audio mode. There are two possible settings for this mode. There are two possible settings for this mode. The first is "IDENT", which will suppress the voice portion of the NAV audio signal and emphasize the Morse Code station identifier (unit will display "ID" in the upper-left corner of the NAV page). The second choice is "VOICE", which will emphasize voice signal and suppress the Morse Code station identifier.

**Message format:**

"V" .....Message class. This is a VHF NAV message.

"29" .....Message identifier.

a.....NAV audio mode. "I" = IDENT, "V" = VOICE

**Example message:**

$PGRMV29I<chksm><CR><LF>

The current NAV Audio mode is "IDENT".

#### B.2.4.2.13 NAV Volume Level

This message is used to output the NAV volume level.

**Message format:**

"V" .....Message class. This is a GNC NAV message.

40 .....Message ident.

vv .....Volume level: 00-FFh; use encoded hex (30h-3Fh).

**Example message:**

$PGRMV4030<chksm><CR><LF>

The headphone volume level is 30h out of FFh.

**Table B-3. Input Message Summary**

| Class | Ident | Description | Response | Comment |
|---|---|---|---|---|
| C | 00 | Set Active COM Frequency and Transceiver Function | COM Transceiver Status | |
| C | 01 | Set Standby COM Frequency and Transceiver Function | COM Transceiver Status | |
| C | 02 | Set COM Audio Items | COM Audio Status | |
| C | 06 | Request COM data | GTR/GNC COM Status | |
| V | 24 | Request Data Output | GNC NAV Status | |
| V | 27 | Set Active VOR/LOC Frequency and Receiver Function | NAV Receiver Status | |
| V | 28 | Set Standby VOR/LOC Frequency and Receiver Function | NAV Receiver Status | |
| | | | | |
| V | 31 | Set NAV Audio Mode | NAV Audio Mode | |
| V | 34 | Set OBS Value | | |
| | | | | |
| | | | | |
| Notes | Class: “C” = GTR/GNC COM message, “V” = GNC NAV message. | | | |

**Table B-4. Output Message Summary**

| Class | Ident | Description | Length | Output Rate | Comment |
|---|---|---|---|---|---|
| V | 20 | Reset Status | 12 | At startup / Upon request | |
| V | 21 | CDI, VDI and Flags | 18 | High | |
| V | 22 | Decoded OBS setting | 16 | High | |
| V | 23 | Radial From Active VOR | 17 | High | |
| V | 25 | Decoded Station Identifier | 18 | Low | |
| V | 27 | Communications Error | 13 | When error detected | |
| V | 28 | NAV Receiver Status | 17 | status change / Low | |
| V | 29 | NAV Audio Mode | 13 | Upon request / status change | |
| V | 35 | Comm Transceiver Status | 18 | status change / Low | |
| V | 36 | Comm Software Version | 17 | Upon request | |
| | | | | | |
| **Notes** | Length is in bytes and includes the “$” start of message character and the <CR><LF> end of message sequence. | | | | |

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# APPENDIX C MECHANICAL DRAWINGS

## C.1 Drawing List

The following drawings are included in this section.

- Figure C-1. GTR/GNC Dimensions
- Figure C-2. GTR/GNC Mounting Rack
- Figure C-3. GNC Center of Gravity
- Figure C-4. GTR Center of Gravity
- Figure C-5. GTR/GNC Rear Connector Layout Detail
- Figure C-6. Panel Cutout Detail
- Figure C-7. GTR Mounting Rack

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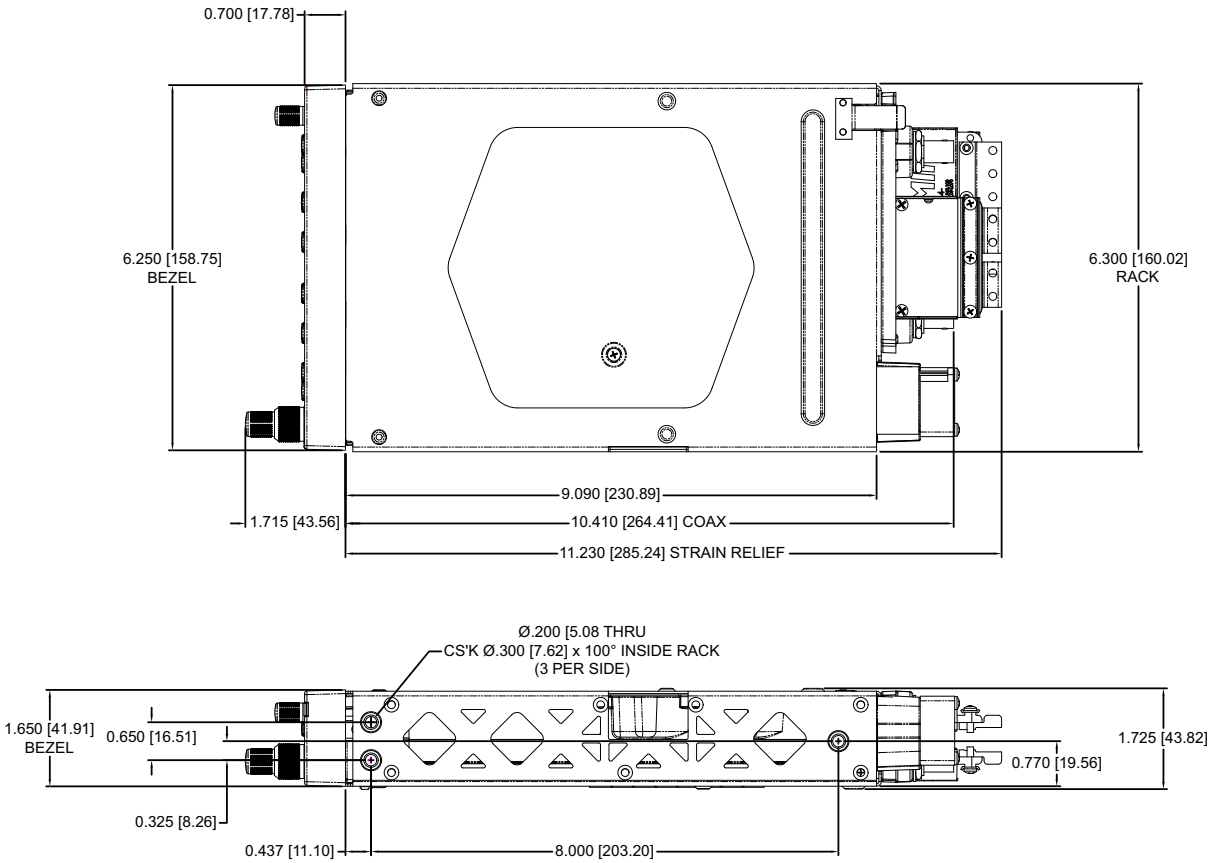
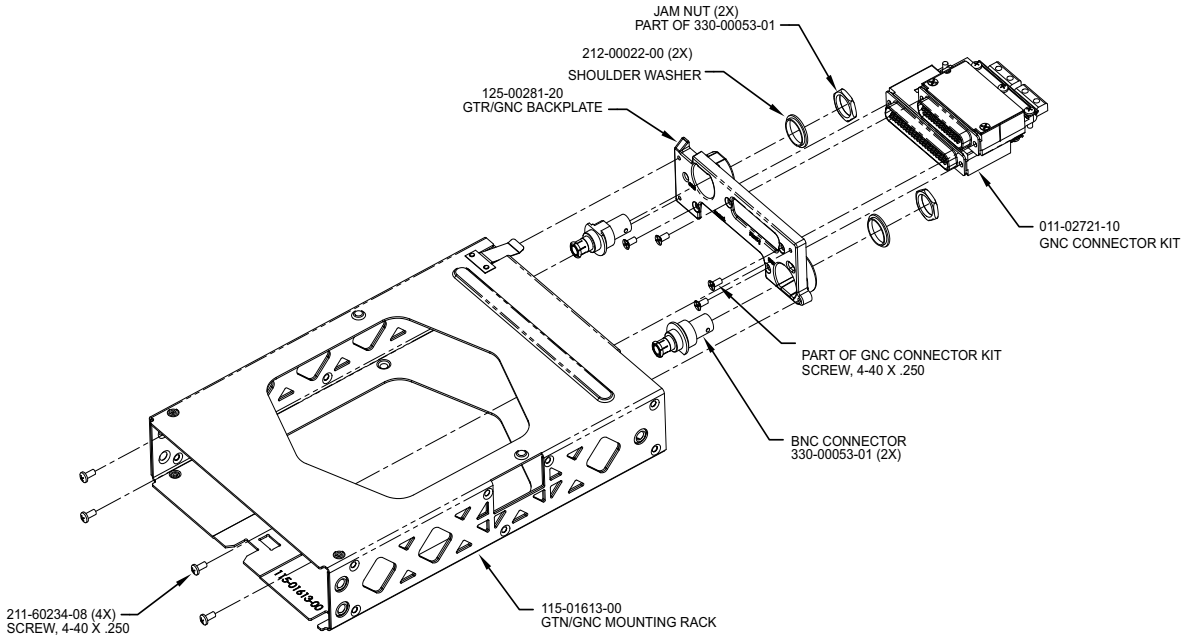



**Figure C-1. GTR/GNC Dimensions**




GTR/GNC MOUNTING RACK ASSEMBLY - EXPLODED VIEW

**Figure C-2. GTR/GNC Mounting Rack**

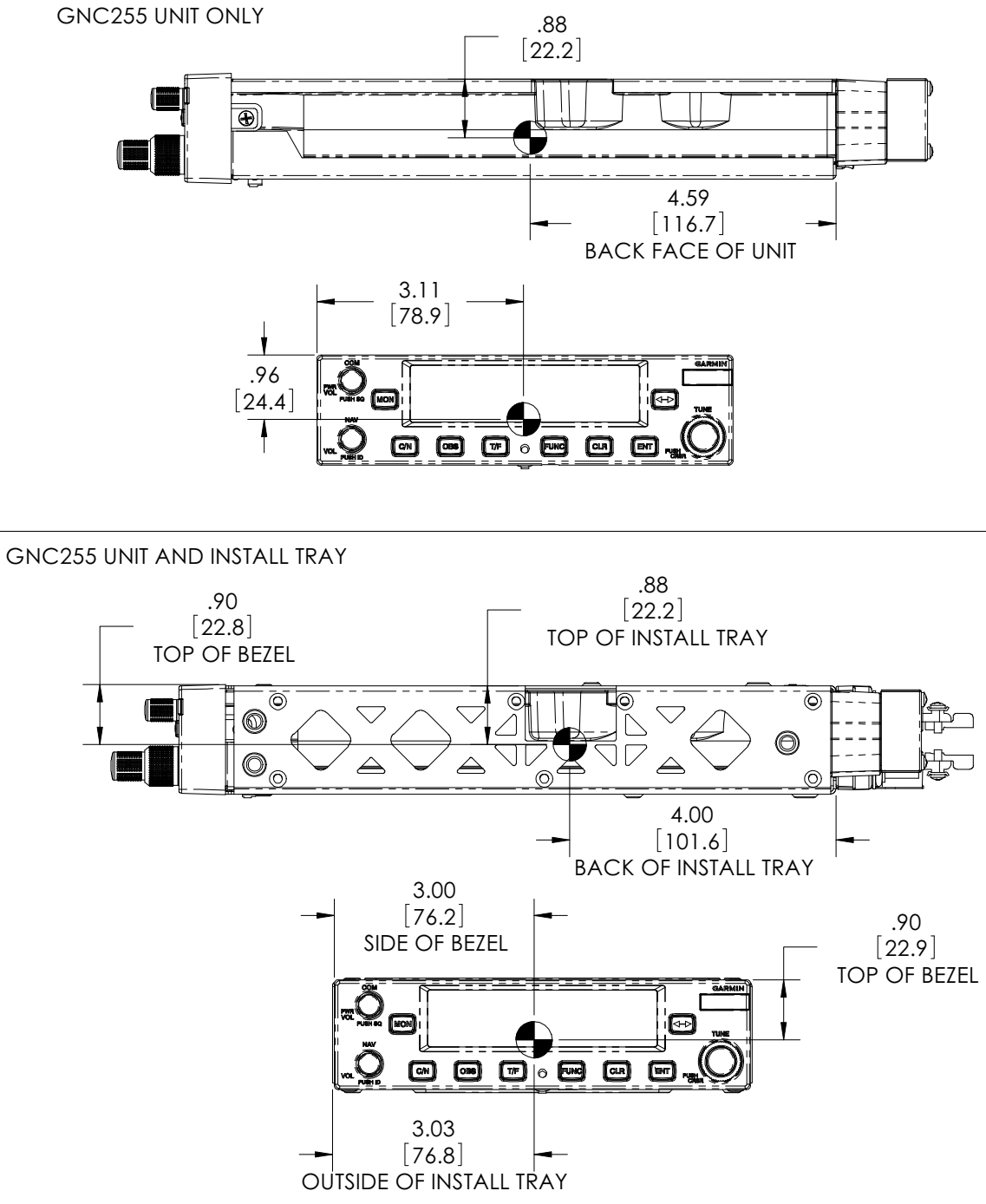
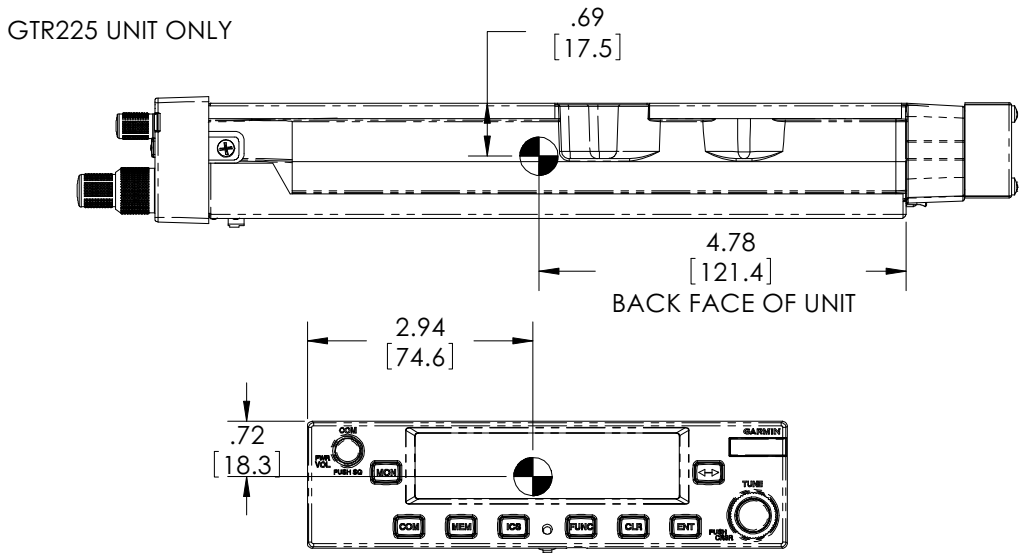
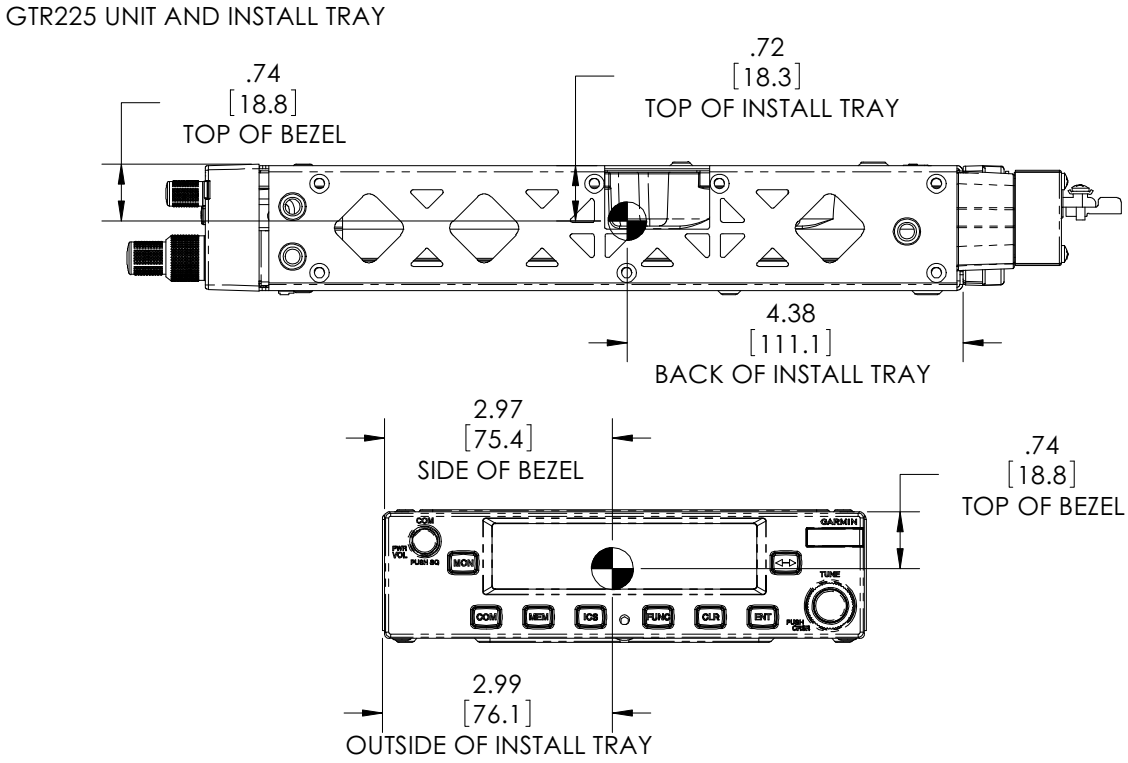


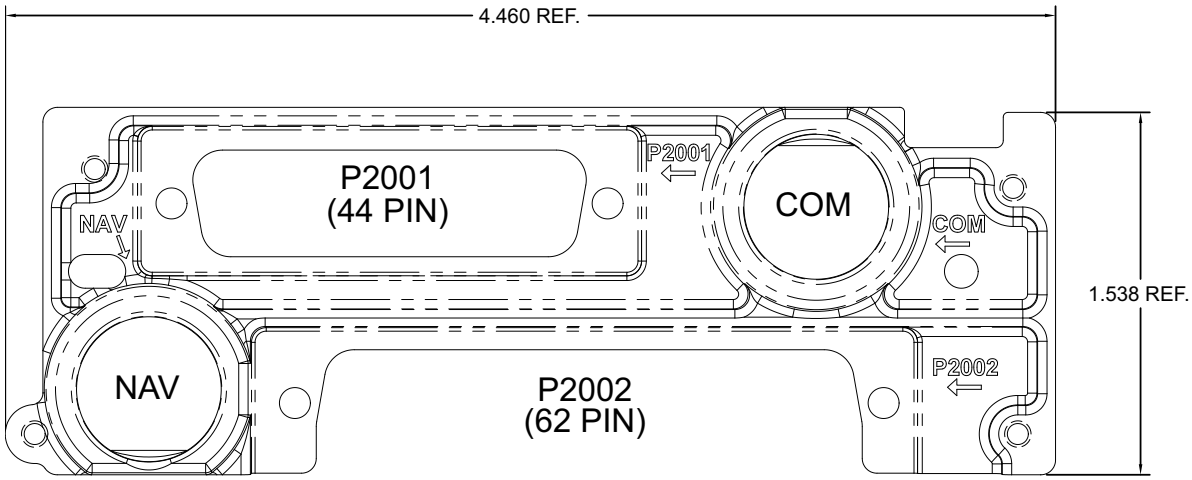

**Figure C-3. GNC Center of Gravity**



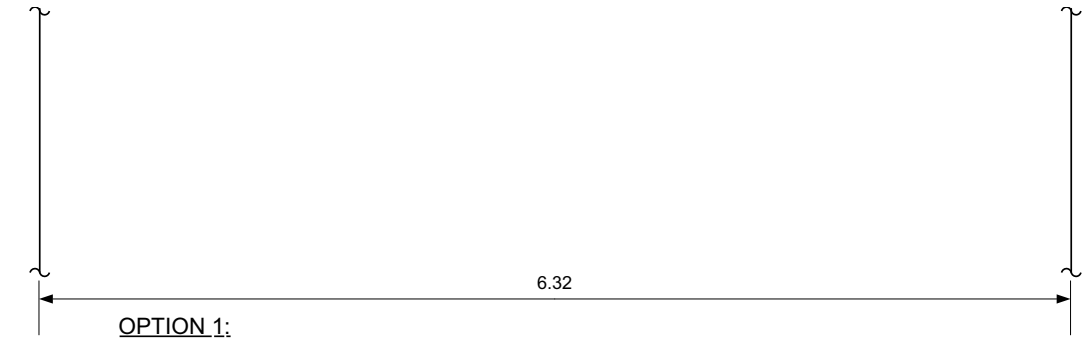

NOTES:
1. DIMENSIONS ARE IN INCHES
2. DIMENSIONS ARE FOR REFERENCE ONLY

**Figure C-4. GTR Center of Gravity**



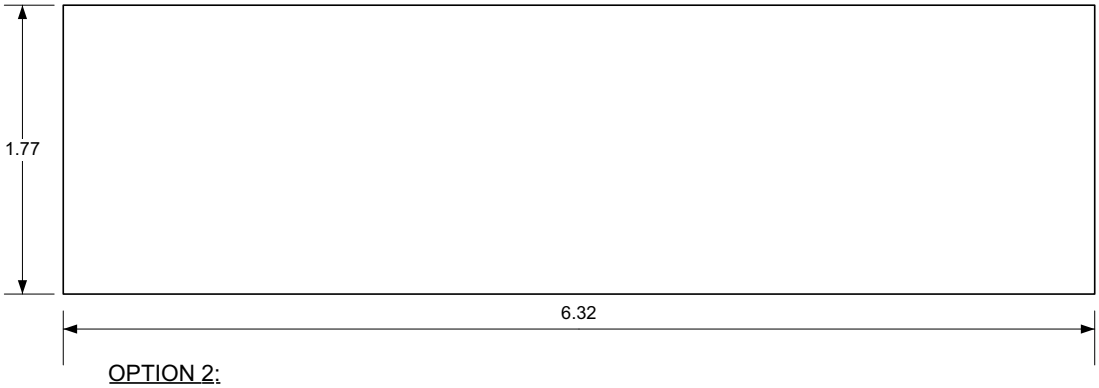

GTR/GNC - REAR VIEW OF CONNECTOR PLATE

**Figure C-5. GTR/GNC Rear Connector Layout Detail**



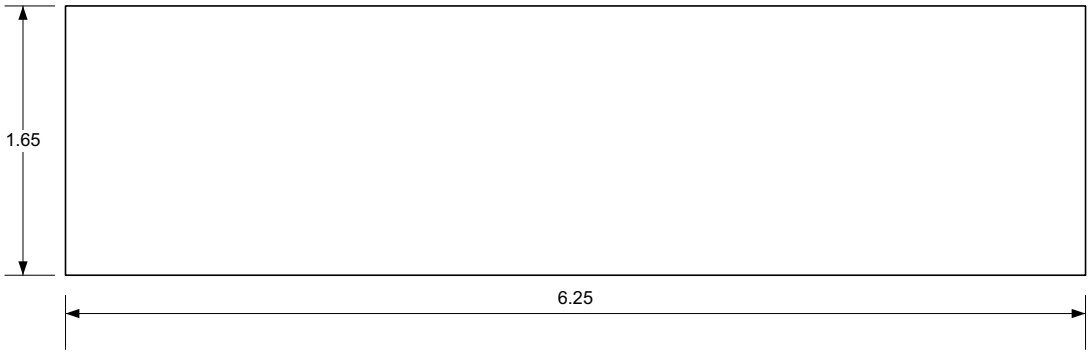

OPTION 1:

STACK CUTOUT (RACK INSTALLED FROM FRONT OF AIRCRAFT PANEL)




OPTION 2:

RADIO CUTOUT (RACK INSTALLED FROM FRONT OF AIRCRAFT PANEL)




OPTION 3:

RADIO CUTOUT (RACK INSTALLED FROM BACK OF AIRCRAFT PANEL ONLY) MAXIMUM AIRCRAFT PANEL THICKNESS IS .125 INCH.

NOTES, ALL OPTIONS:

1. DIMENSIONS ARE IN INCHES.
2. IF THE FRONT LIP OF THE MOUNTING RACK IS BEHIND THE SURFACE OF THE AIRCRAFT INSTRUMENT PANEL, THE UNIT CONNECTORS MAY NOT FULLY ENGAGE.
3. TOLERANCE: +0.03 INCHES.

**Figure C-6. Panel Cutout Detail**

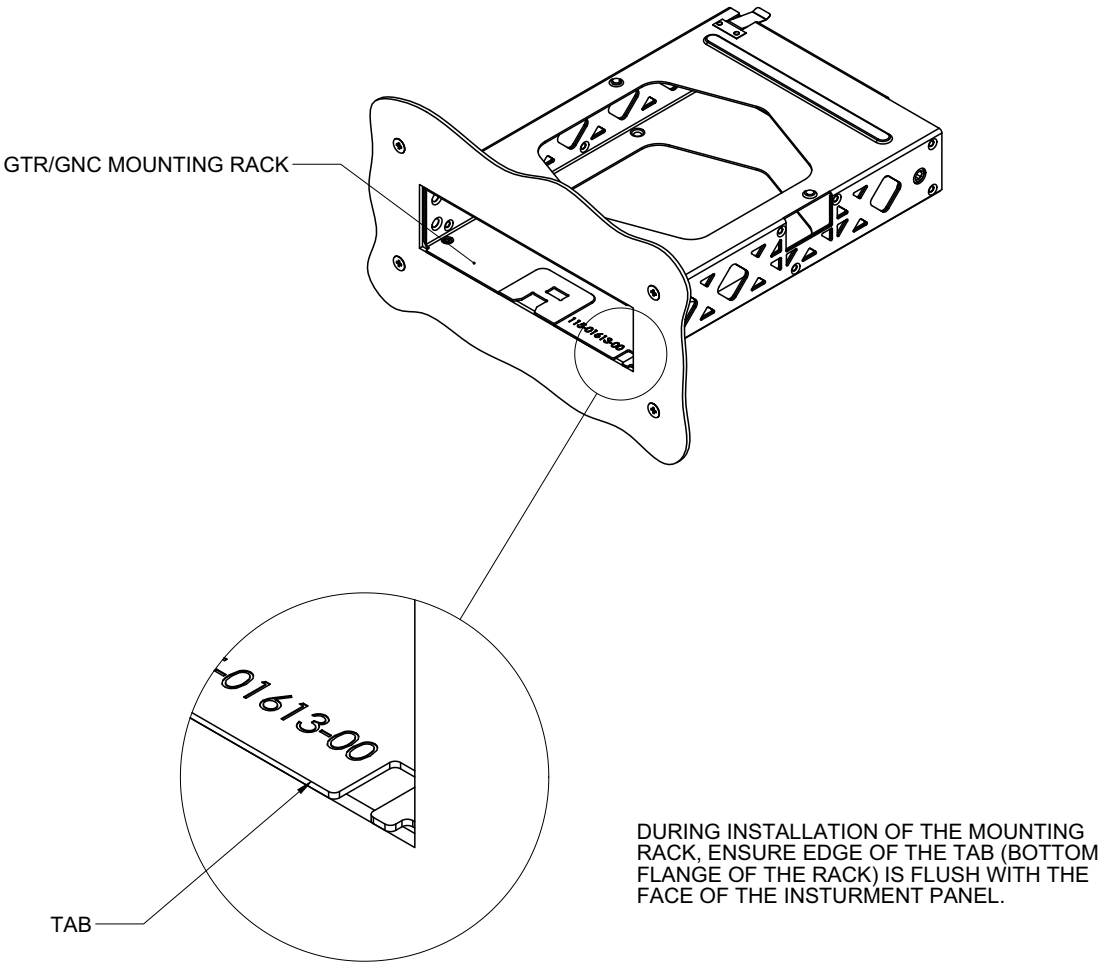

GTR/GNC MOUNTING RACK
-01613-00
TAB
DURING INSTALLATION OF THE MOUNTING RACK, ENSURE EDGE OF THE TAB (BOTTOM FLANGE OF THE RACK) IS FLUSH WITH THE FACE OF THE INSTURMENT PANEL.

**Figure C-7. GTR Mounting Rack**

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# APPENDIX D INTERCONNECT DIAGRAMS

## D.1 Drawing List

The following drawings are included in this section:

- Figure D-1. GTR/GNC System Interface Diagram
- Figure D-2. GTR/GNC Typical Installation
- Figure D-3. GTR/GNC Power Lighting Configuration Interconnect
- Figure D-4. GTR/GNC - Antennas Interconnect
- Figure D-5. GTR/GNC - Audio Panel Interconnect
- Figure D-6. GTR/GNC - MIC Interconnect
- Figure D-7. GTR/GNC - VOR/ILS Interconnect
- Figure D-8. GTR/GNC Switches Interconnect
- Figure D-9. RMI OBI Interconnect
- Figure D-10. GNC - King Serial DME - Remote Mount Interconnect
- Figure D-11. Parallel 2 of 5 DME Tuning Interconnect
- Figure D-12. Parallel Slip Code DME Tuning Interconnect
- Figure D-13. GNC - King Serial DME - Panel Mount Interconnect
- Figure D-14. GTR/GNC - GDU 620 Interconnect
- Figure D-15. GTR/GNC - GTN and GNS 400W/500W

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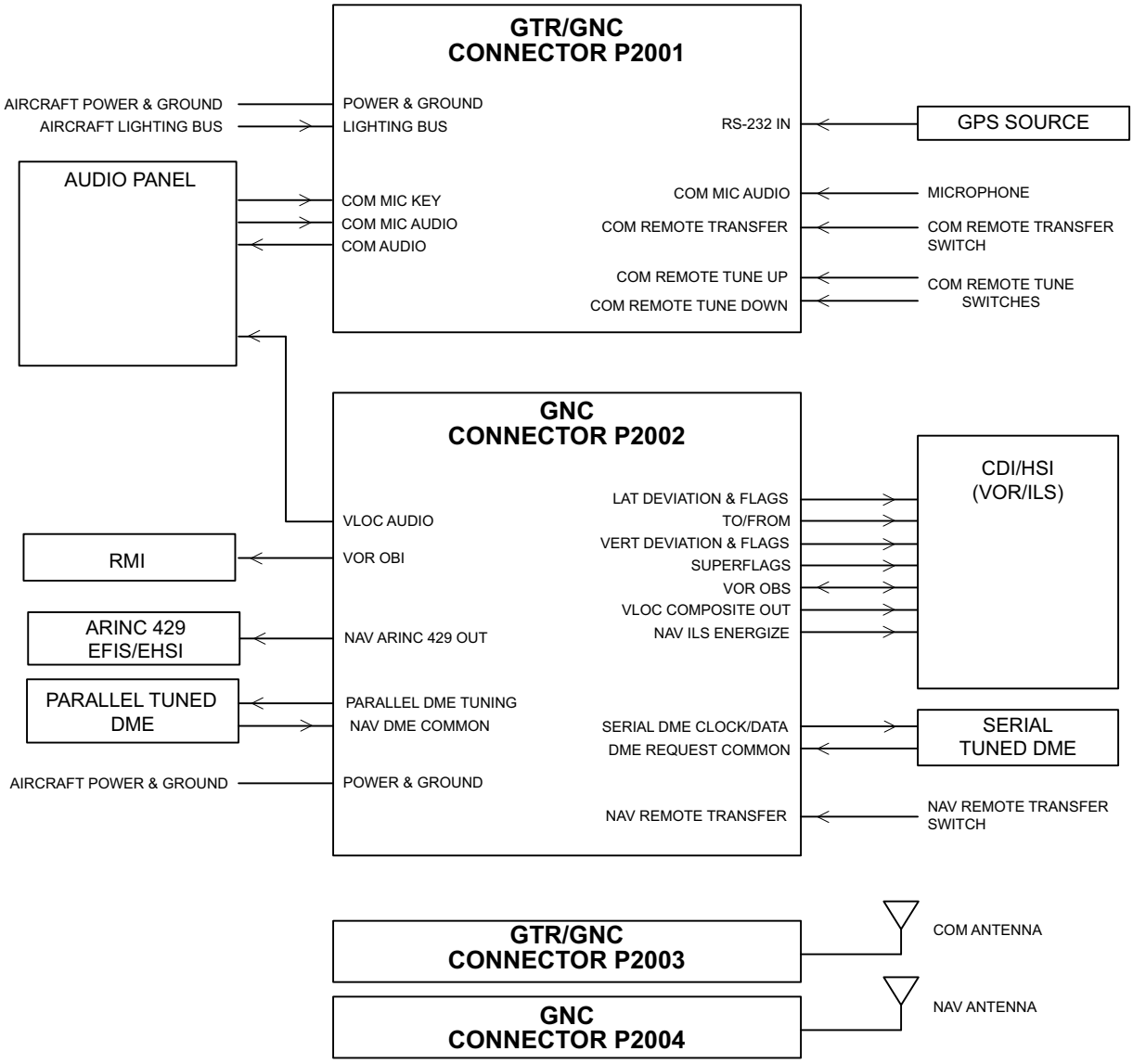



**Figure D-1. GTR/GNC System Interface Diagram**

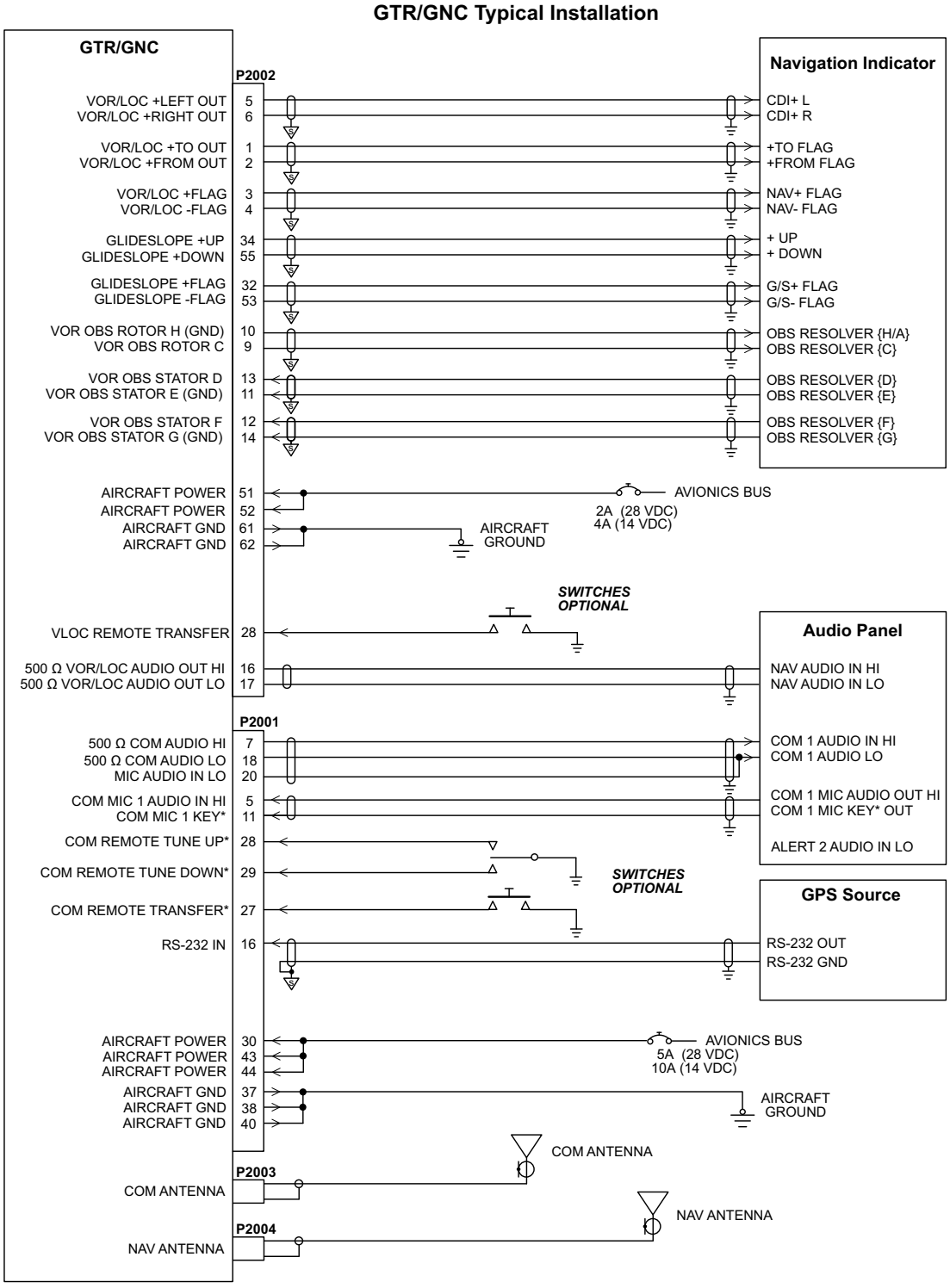
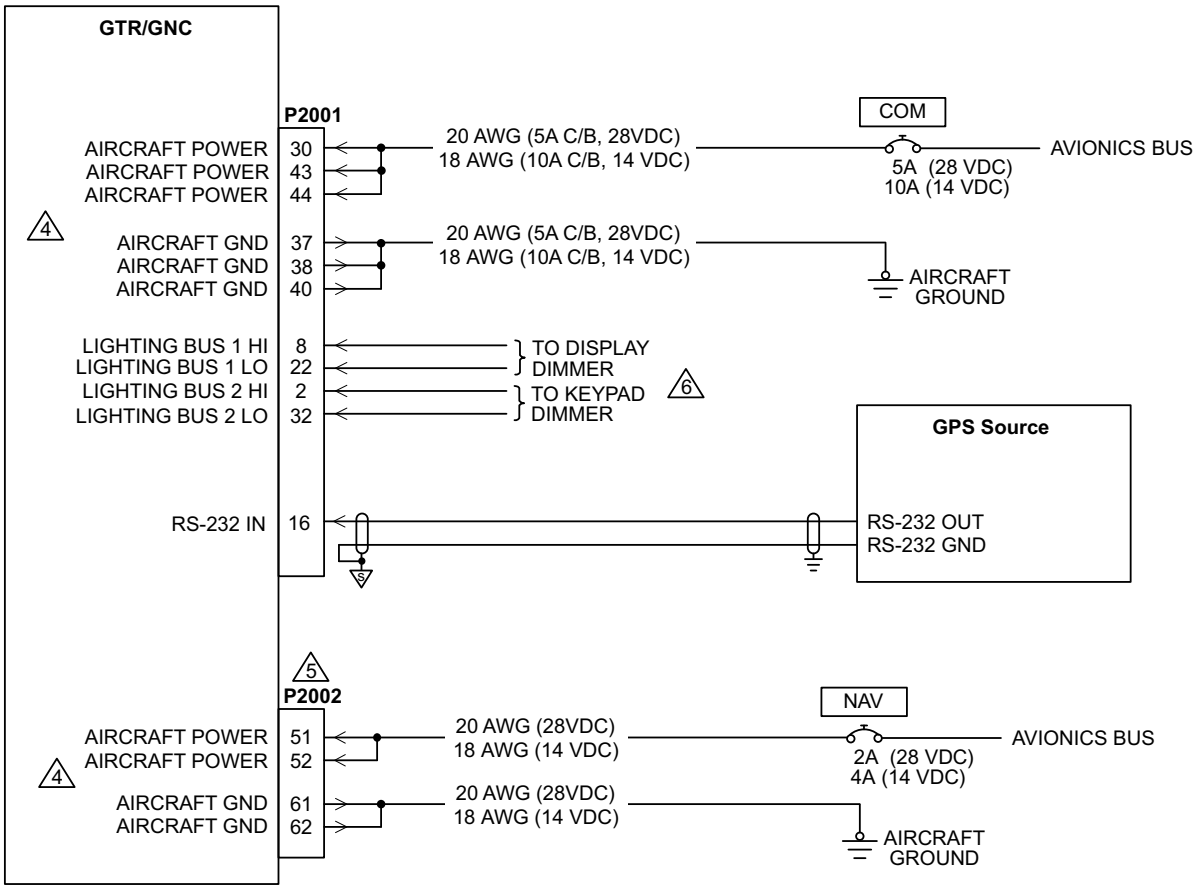



**Figure D-2. GTR/GNC Typical Installation**
**Sheet 1 of 2**

**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: ⏚ SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND
3. AT THE GTR/GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL -- THE SHIELD TERMINATION LE BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIR
4. REFER TO FIGURE D-3 FOR POWER AND GROUND WIRING DETAILS.

**Figure D-2. GTR/GNC Typical Installation**
**Sheet 2 of 2**




**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND ⏚

3 AT THE GTR/GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL—THE SHIELD LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

4 ALL POWER LEADS AND GROUND LEADS ARE REQUIRED.

5 CONNECTOR P2002 IS ONLY APPLICABLE TO THE GNC 255.

6 OPTIONAL CONNECTION. LIGHTING CAN BE CONTROLLED BY THE INTEGRATED PHOTOCELL, A SINGLE LIGHTING BUS, OR DUAL LIGHTING BUSES.

**Figure D-3. GTR/GNC Power Lighting Configuration Interconnect**

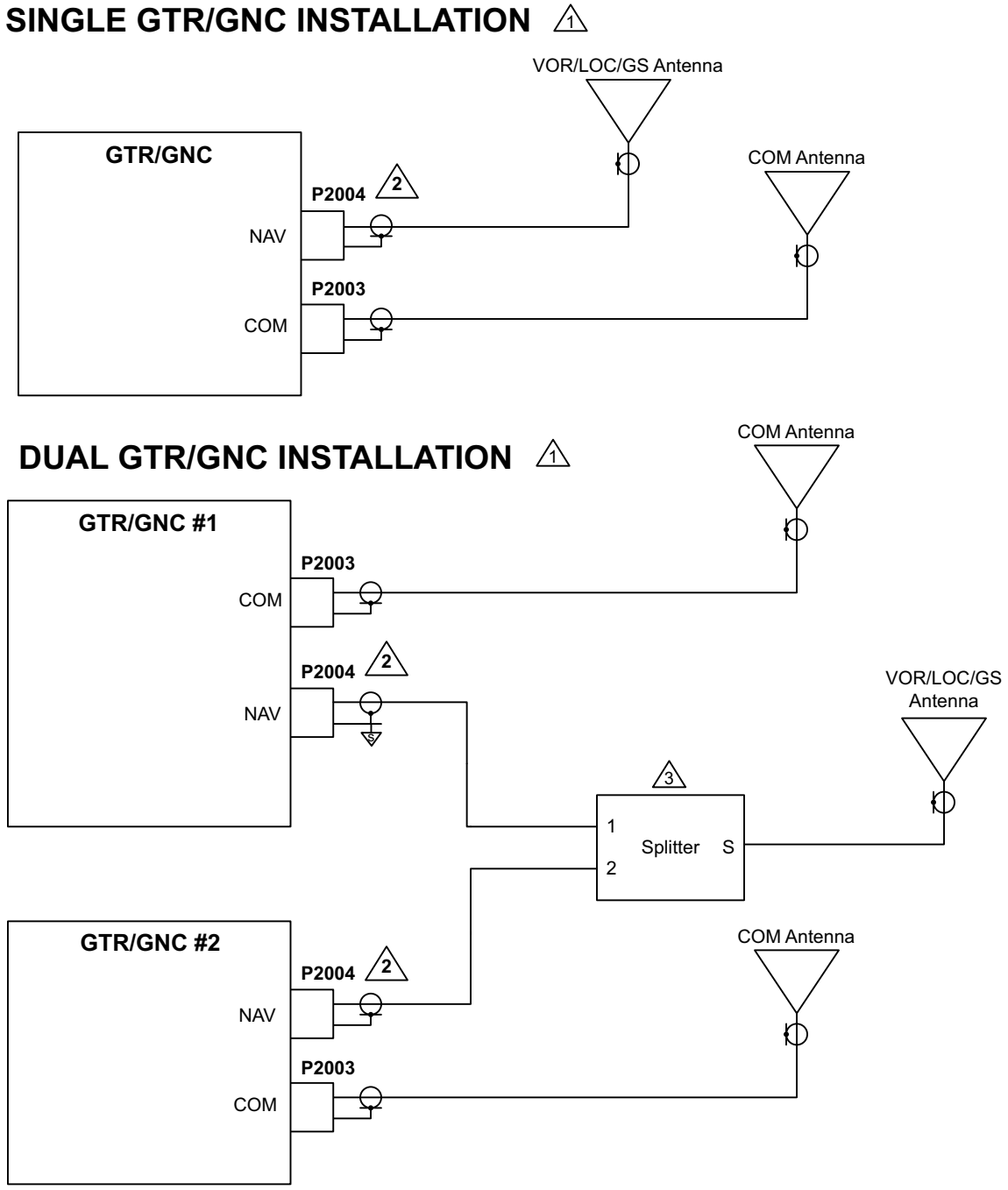
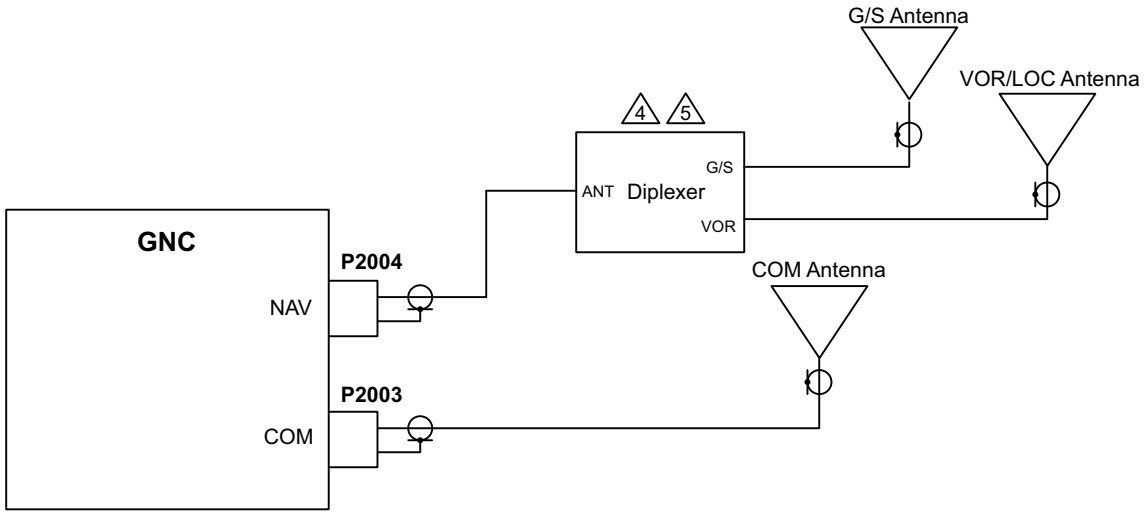



**Figure D-4. GTR/GNC - Antennas Interconnect**
**Sheet 1 of 4**

## SINGLE GNC/DUAL NAV ANTENNA INSTALLATION 1




## DUAL GNC/DUAL NAV ANTENNA INSTALLATION 1

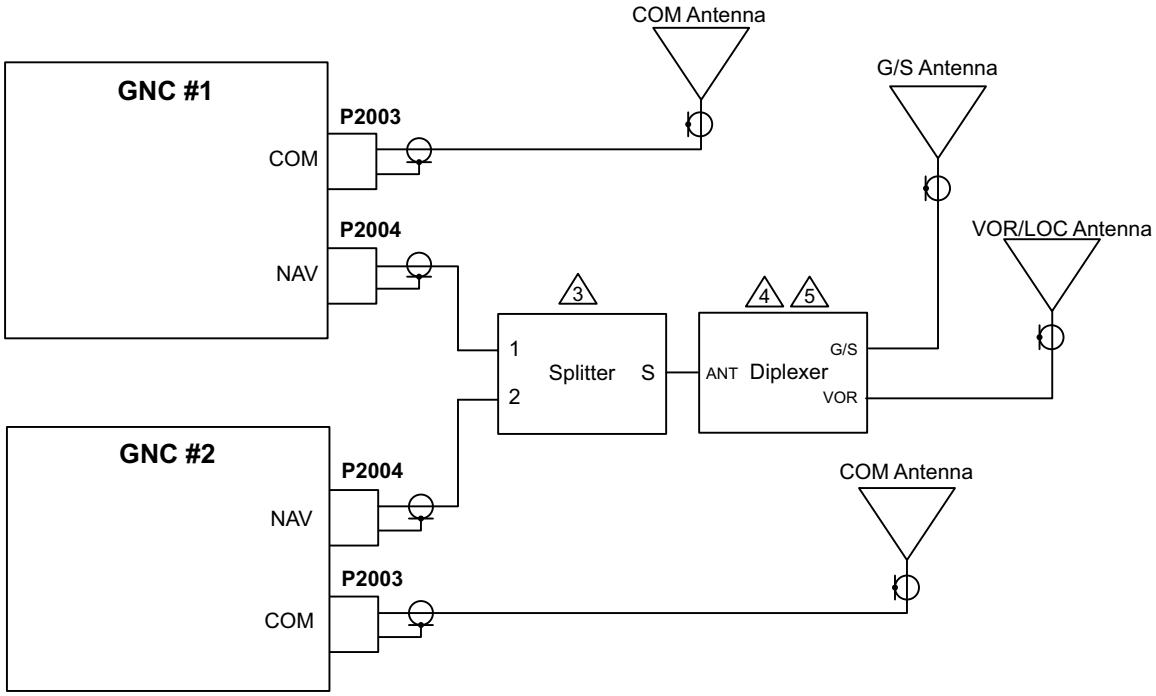
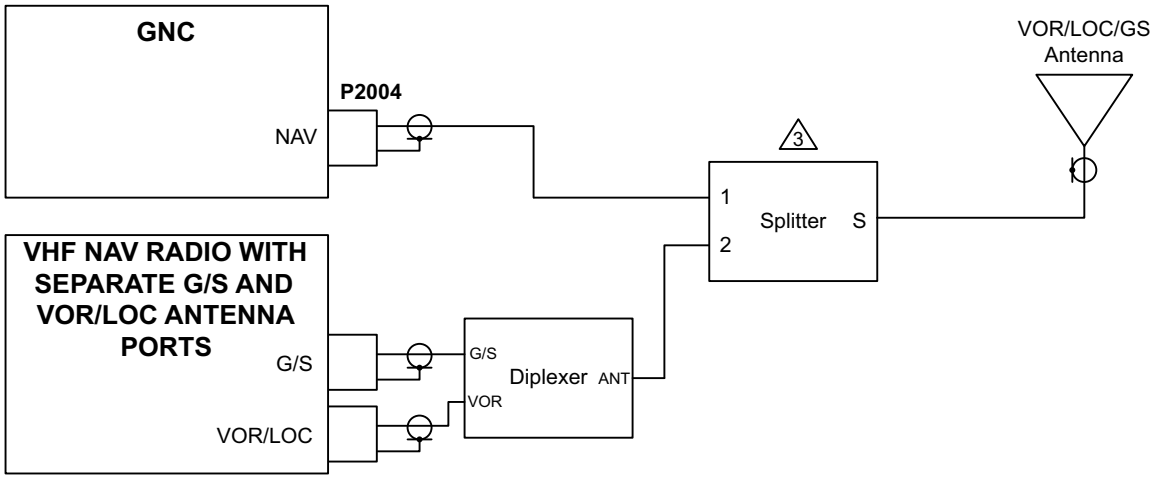



**Figure D-4. GTR/GNC - Antennas Interconnect**
**Sheet 2 of 4**

## SINGLE GNC, OTHER RADIO, AND SINGLE ANTENNA




## SINGLE GNC, OTHER RADIO AND DUAL ANTENNAS

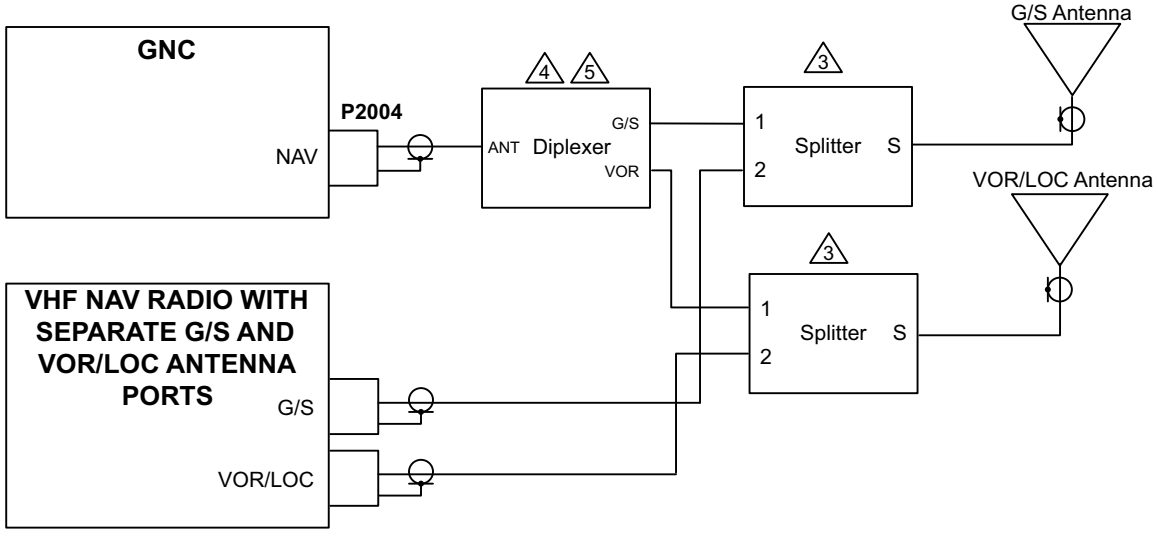



**Figure D-4. GTR/GNC - Antennas Interconnect**
**Sheet 3 of 4**

**NOTES:**

1. REFER TO SECTIONS 3 AND 4 FOR ANTENNA CABLE SPECIFICATIONS.
2. P2004 NAV ANTENNA PORT IS ONLY APPLICABLE TO THE GNC MODEL.
3. GARMIN P/N 013-00112-00 (MINI-CIRCUITS SPLITTER P/N ZFSC-2-1B+) MAY BE USED.
4. COMANT DIPLEXER P/N CI 507 MAY BE USED.
5. THE DIPLEXER IS INSTALLED BACKWARDS FROM TRADITIONAL APPLICATIONS. WHEN A G/S AND VOR/LOC ANTENNA IS INSTALLED, IT IS REQUIRED TO JOIN THE SIGNALS OF BOTH ANTENNAS WITH THE CI-507 DIPLEXER.

**Figure D-4. GTR/GNC - Antennas Interconnect**
**Sheet 4 of 4**

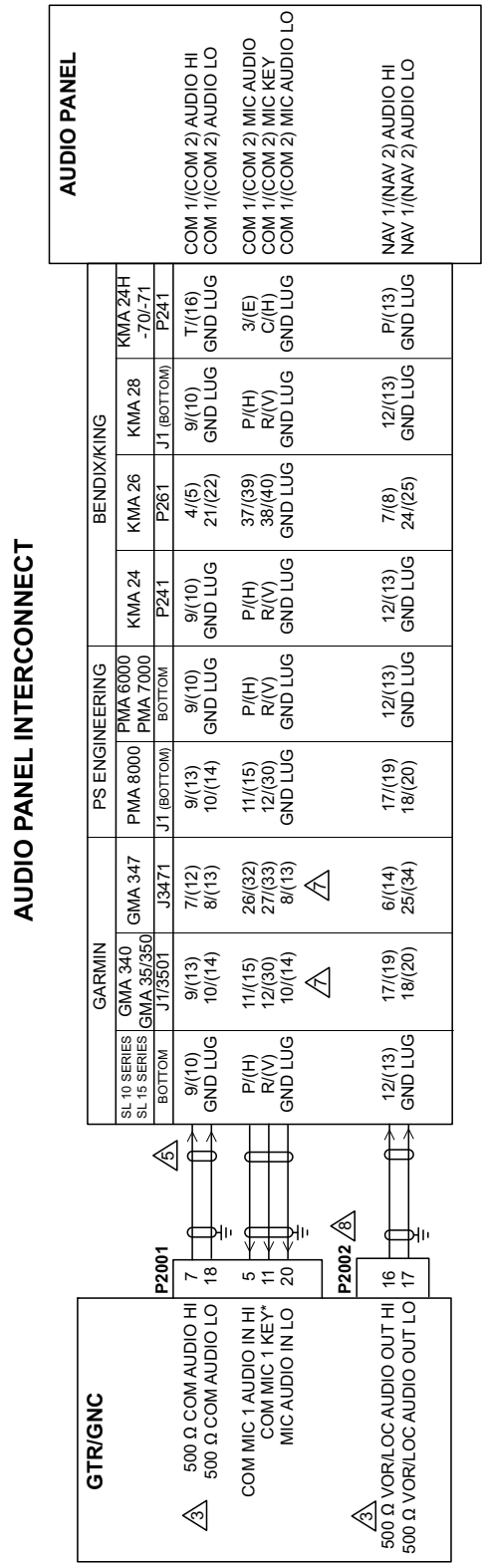
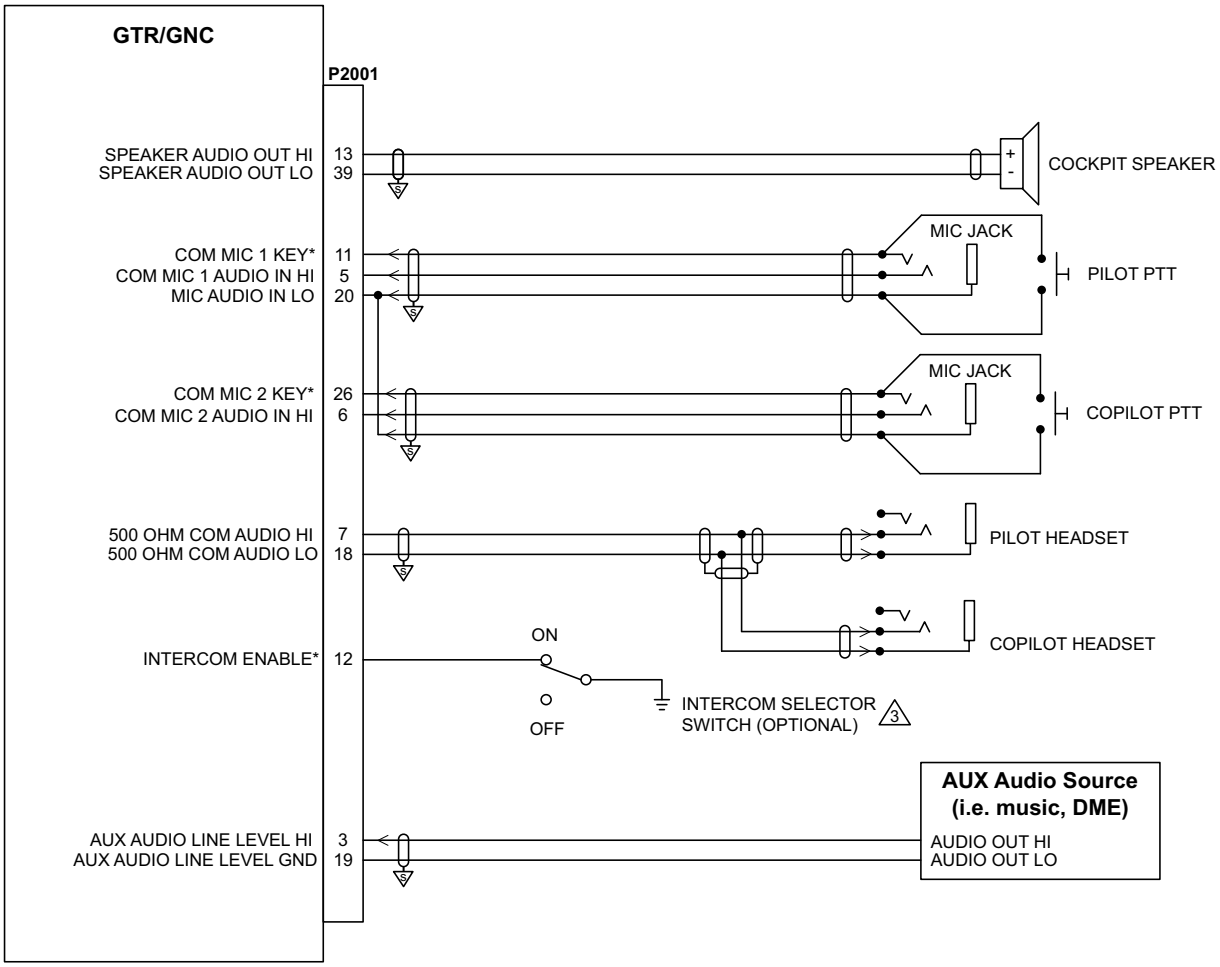



**Figure D-5. GTR/GNC - Audio Panel Interconnect**
**Sheet 1 of 2**

**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: ⏚ SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND
3. THE 500 OHM AUDIO OUTPUTS ARE BALANCED OUTPUTS, AND THE LO OUTPUTS NEED TO BE CONNECTED. IF THE AUDIO PANEL DOES NOT HAVE A LO INPUT, THE LO OUTPUT SHOULD BE CONNECTED TO A GROUND LUG AT THE AUDIO PANEL.
4. REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.
5. SHIELDS FOR AUDIO CABLES SHOULD BE GROUNDED AT ONE END (WITH LEADS LESS THAN 3.0 INCHES) AND LEFT FLOATING AT THE OTHER END. IF SHIELDED AUDIO CABLE IS CARRIED THROUGH A DISCONNECT, CARRY THE SHIELD GROUND THROUGH THE DISCONNECT ON A SEPARATE PIN.
6. CONNECTING TWO MICROPHONES TO MIC AUDIO HI/LO AT THE SAME TIME MAY RESULT IN WEAK OR DISTORTED AUDIO. MIC ISOLATION RELAYS ARE RECOMMENDED SO THAT ONLY ONE MIC IS ACTIVE AT A TIME.
7. SPLICE 500Ω COM AUDIO LO AND MIC AUDIO IN LO TOGETHER INTO THE SAME PIN ON AUDIO PANEL.
8. THE P2002 NAV CONNECTOR IS ONLY APPLICABLE TO THE GNC MODEL.

**Figure D-5. GTR/GNC - Audio Panel Interconnect**
**Sheet 2 of 2**




**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: SHIELD BLOCK GROUND  AIRFRAME GROUND
3. THE INTERCOM ON/OFF SWITCH IS AN OPTIONAL SWITCH THAT MAY BE INSTALLED TO ENABLE/DISABLE THE GTR/GNC INTERCOM FUNCTION. ALTERNATELY, THE INTERCOM MAY BE ENABLED/DISABLED VIA THE FUNCTION MENU OPTIONS ON THE GTR/GNC.

**Figure D-6. GTR/GNC - MIC Interconnect**

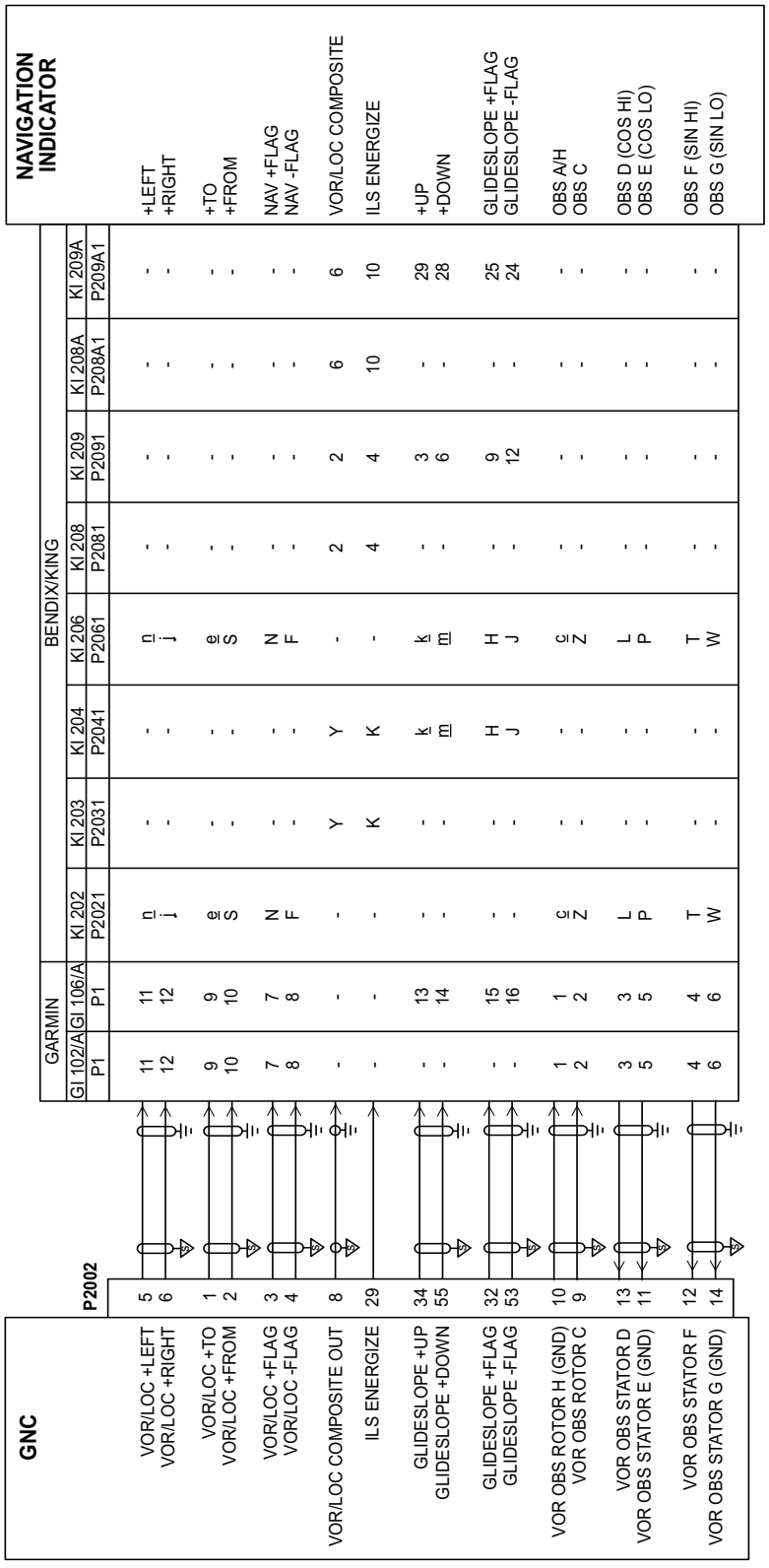
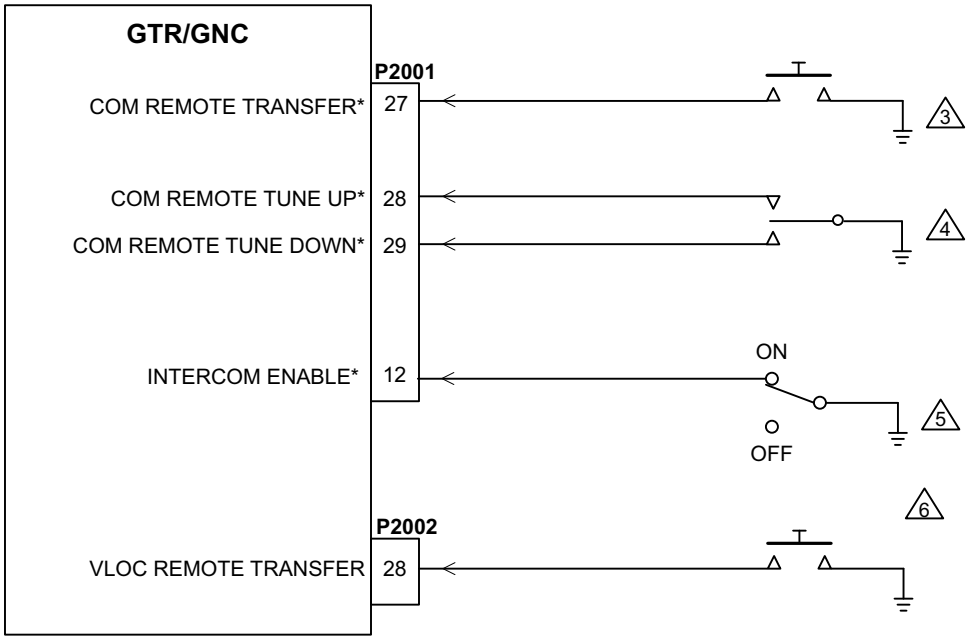



**Figure D-7. GTR/GNC - VOR/ILS Interconnect**
**Sheet 1 of 2**

**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: ⏚ SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND
3. AT GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL -- THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIREMENTS.
4. REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.

**Figure D-7. GTR/GNC - VOR/ILS Interconnect**
**Sheet 2 of 2**

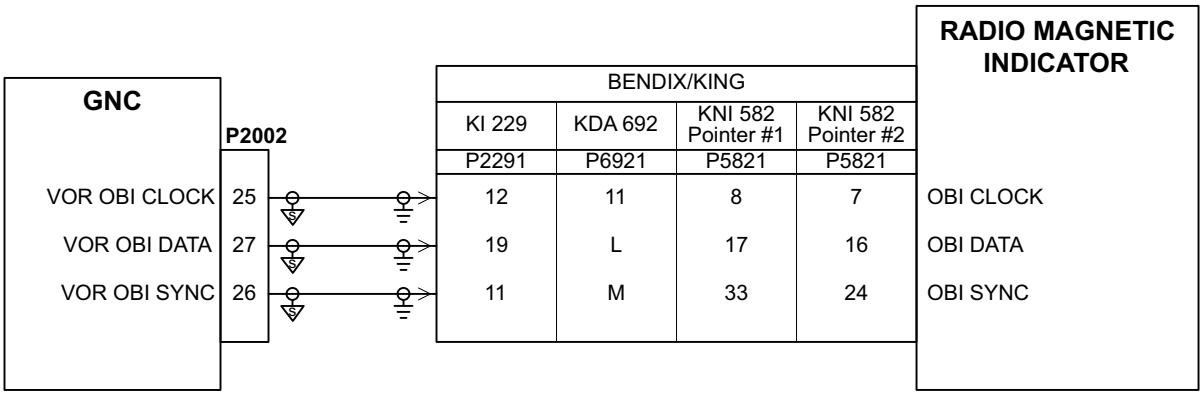



**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: SHIELD BLOCK GROUND AIRFRAME GROUND
3. COM REMOTE TRANSFER CAN BE USED TO TRANSFER THE STANDBY COM FREQUENCY TO THE ACTIVE COM FREQUENCY VIA REMOTE SWITCH. MAY OPTIONALLY USE GRAYHILL SWITCH P/N 30-3.
4. COM REMOTE TUNE UP AND COM REMOTE TUNE DOWN CAN BE USED TO SCROLL THROUGH A LIST OF PRESET COM FREQUENCIES. MAY OPTIONALLY USE TWO GRAYHILL SWITCHES P/N 30-3. ALTERNATIVELY, AN ON-OFF-ON SWITCH, CARLINGSWITCH P/N 62012481-0-0 CAN BE USED.
5. THE INTERCOM ON/OFF SWITCH IS AN OPTIONAL SWITCH THAT MAY BE INSTALLED TO ENABLE/DISABLE THE GTR/GNC INTERCOM FUNCTION. ALTERNATELY, THE INTERCOM MAY BE ENABLED/DISABLED VIA THE FUNCTION MENU OPTIONS ON THE GTR/GNC. MAY OPTIONALLY USE GRAYHILL SWITCH P/N 30-3.
6. VLOC REMOTE TRANSFER CAN BE USED TO TRANSFER THE STANDBY NAV FREQUENCY TO THE ACTIVE NAV FREQUENCY VIA REMOTE SWITCH. MAY OPTIONALLY USE GRAYHILL SWITCH P/N 30-3.

**Figure D-8. GTR/GNC Switches Interconnect**

## TYPICAL CONNECTIONS TO RMI




**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND

3 AT GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL -- THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIREMENTS. IF NO SHIELD TERMINATION REQUIREMENT EXISTS FOR THE REMOTE EQUIPMENT, TERMINATE SHIELDS AS SHORT AS POSSIBLE, NOT TO EXCEED 3.0". SEE SECTION <TBD>.

4 REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT/ CONFIGURATION INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.

**Figure D-9. RMI OBI Interconnect**

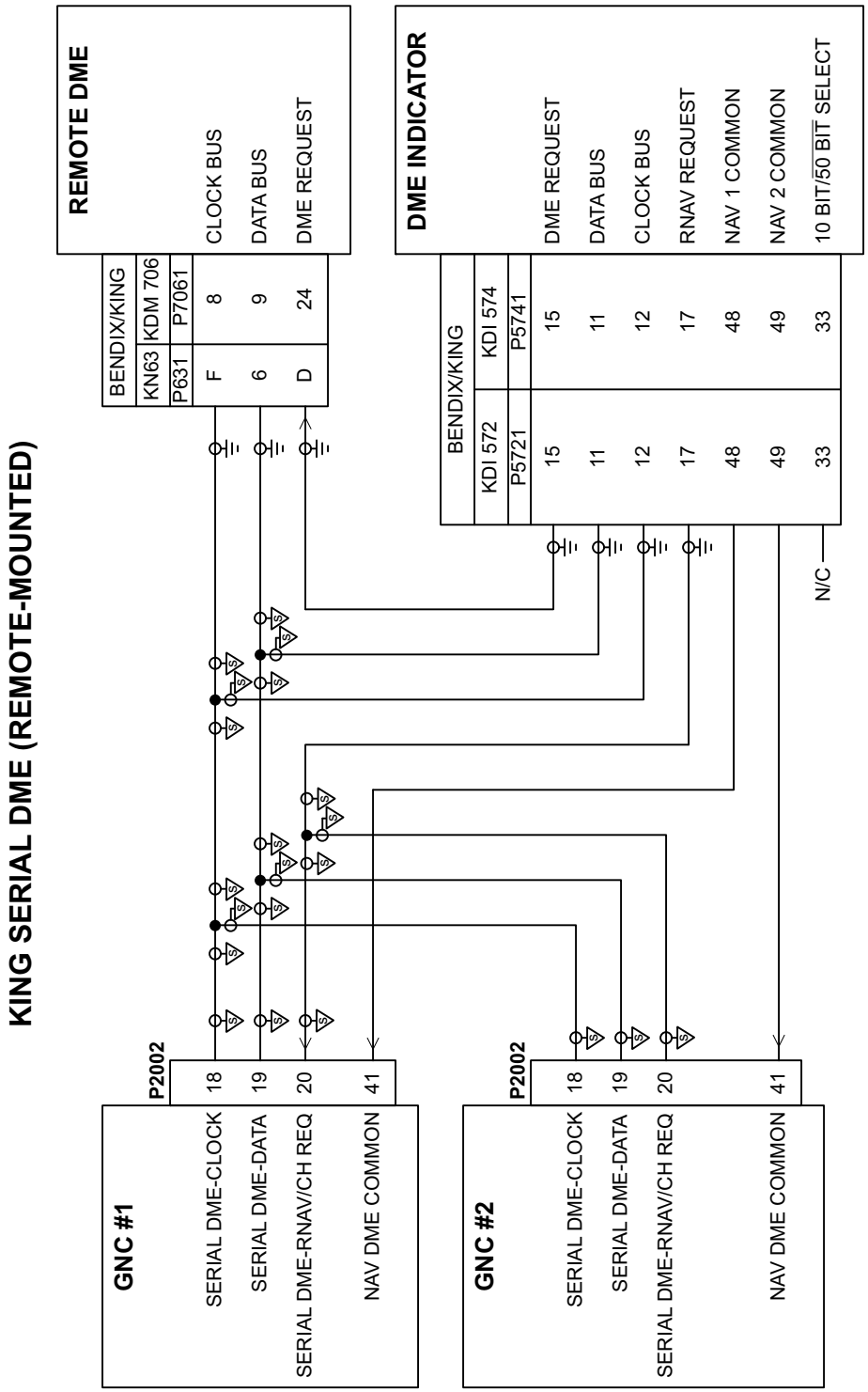



**Figure D-10. GNC - King Serial DME - Remote Mount Interconnect**
**Sheet 1 of 2**

**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: ⏚ SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND

3 AT GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL -- THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0".

4 REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.

5 THE GNC MAY BE CONFIGURED AT INSTALLATION TO OUTPUT KING SERIAL DME TUNING DATA UNDER THE DME CHANNEL MODE. REFER TO SECTION TBD FOR CONFIGURATION SETTINGS.

6 FOR SINGLE GNC INSTALLATIONS, WIRE AS SHOWN FOR GNC #1

**Figure D-10. King Serial DME - Remote Mount Interconnect**
**Sheet 2 of 2**

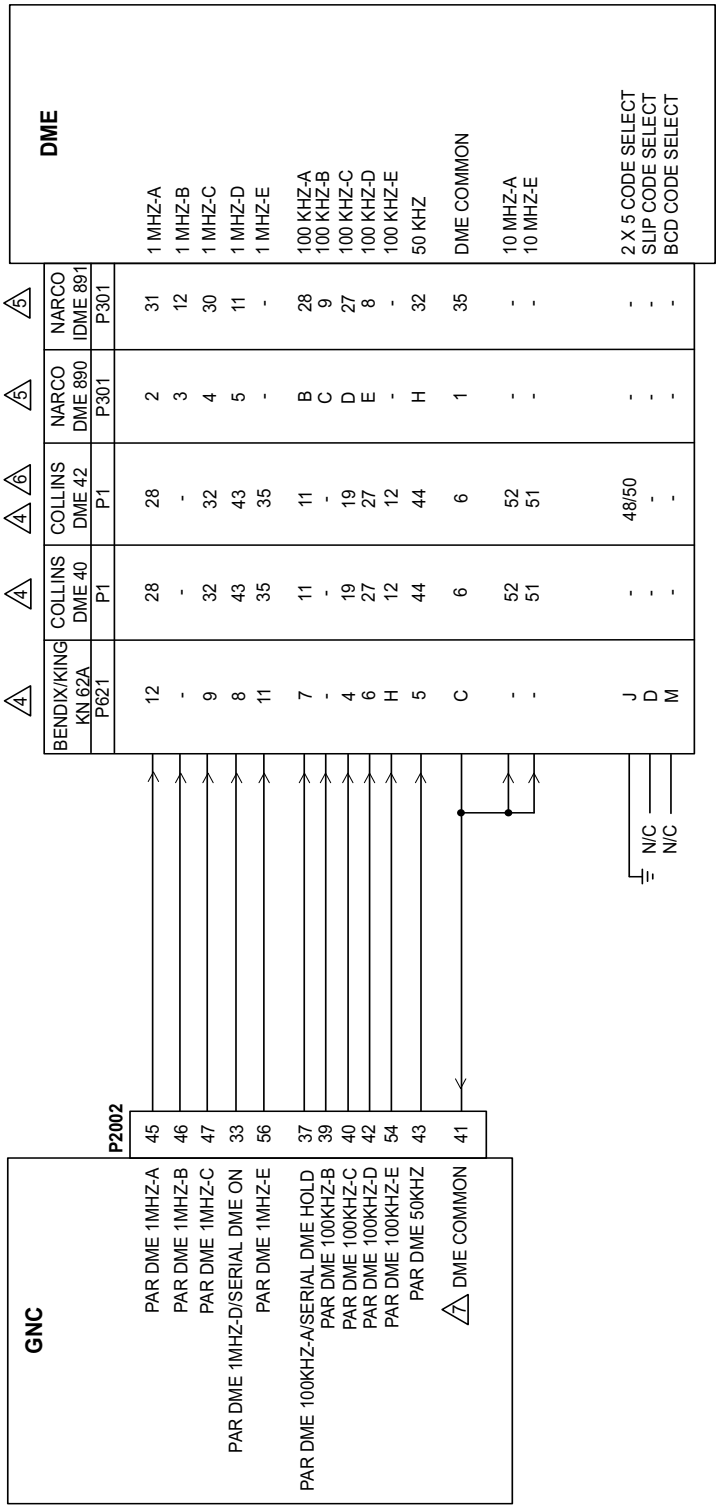
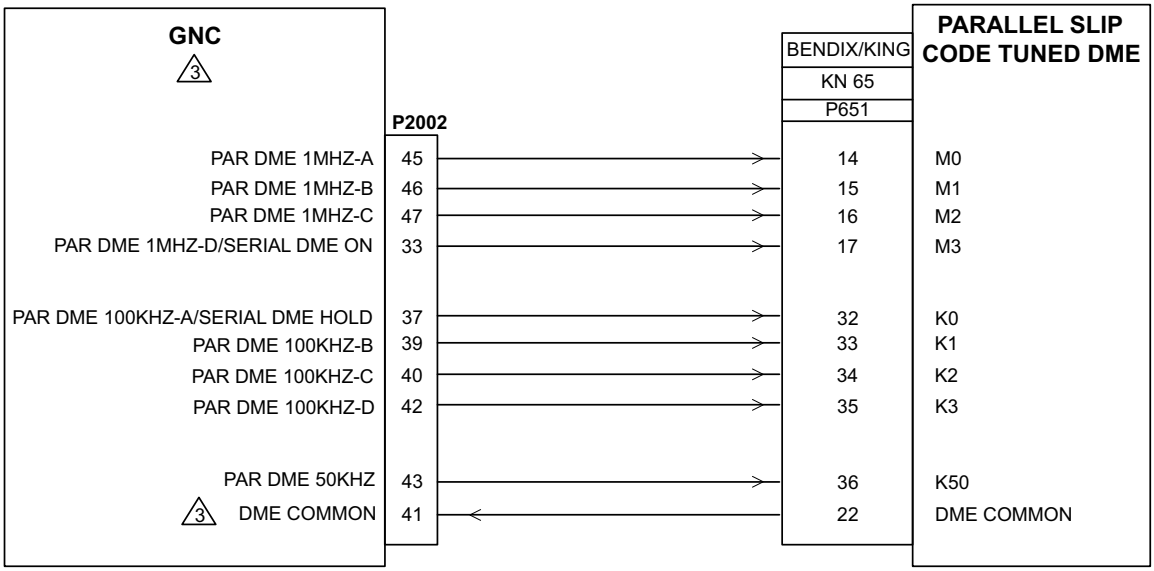



**Figure D-11. Parallel 2 of 5 DME Tuning Interconnect**
**Sheet 1 of 2**

**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. GROUND DESIGNATIONS: ⏚ SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND
3. REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY. REFER TO SECTION TBD FOR GNC CONFIGURATION SETTINGS.
4. THE GNC SHOULD BE CONFIGURED FOR PARALLEL 2X5 DME CHANNELING MODE FOR PROPER OPERATION WITH THIS MODEL OF DME TRANSCEIVER.
5. THE GNC SHOULD BE CONFIGURED FOR NARCO 890/891 DME CHANNELING MODE FOR PROPER OPERATION WITH THIS MODEL OF DME TRANSCEIVER.
6. DME 42 SHOULD BE STRAPPED FOR 2X5 TUNING. REFER TO DME 42 INSTALLATION MANUAL FOR STRAPPING INFORMATION.
7. FOR DUAL GNC INTERFACES TO THE DME, IT MAY BE NECESSARY TO INSTALL A TOGGLE SWITCH FOR THE 'DME COMMON' INPUT. INSTALL SWITCH AS SHOWN FOR KING SERIAL PANEL DME INTERCONNECT.

**Figure D-11. Parallel 2 of 5 DME Tuning Interconnect**
**Sheet 2 of 2**




**NOTES:**

1. ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.
2. REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.
3. THE GNC SHOULD BE CONFIGURED TO OUTPUT SLIP CODE DME TUNING DATA FOR PROPER OPERATION IN THIS CONFIGURATION. REFER TO SECTION 6 FOR CONFIGURATION SETTINGS.
4. FOR DUAL GNC INTERFACES TO THE DME, IT MAY BE NECESSARY TO INSTALL A TOGGLE SWITCH FOR THE 'DME COMMON' INPUT. INSTALL SWITCH AS SHOWN FOR KING SERIAL PANEL DME INTERCONNECT.

**Figure D-12. Parallel Slip Code DME Tuning Interconnect**

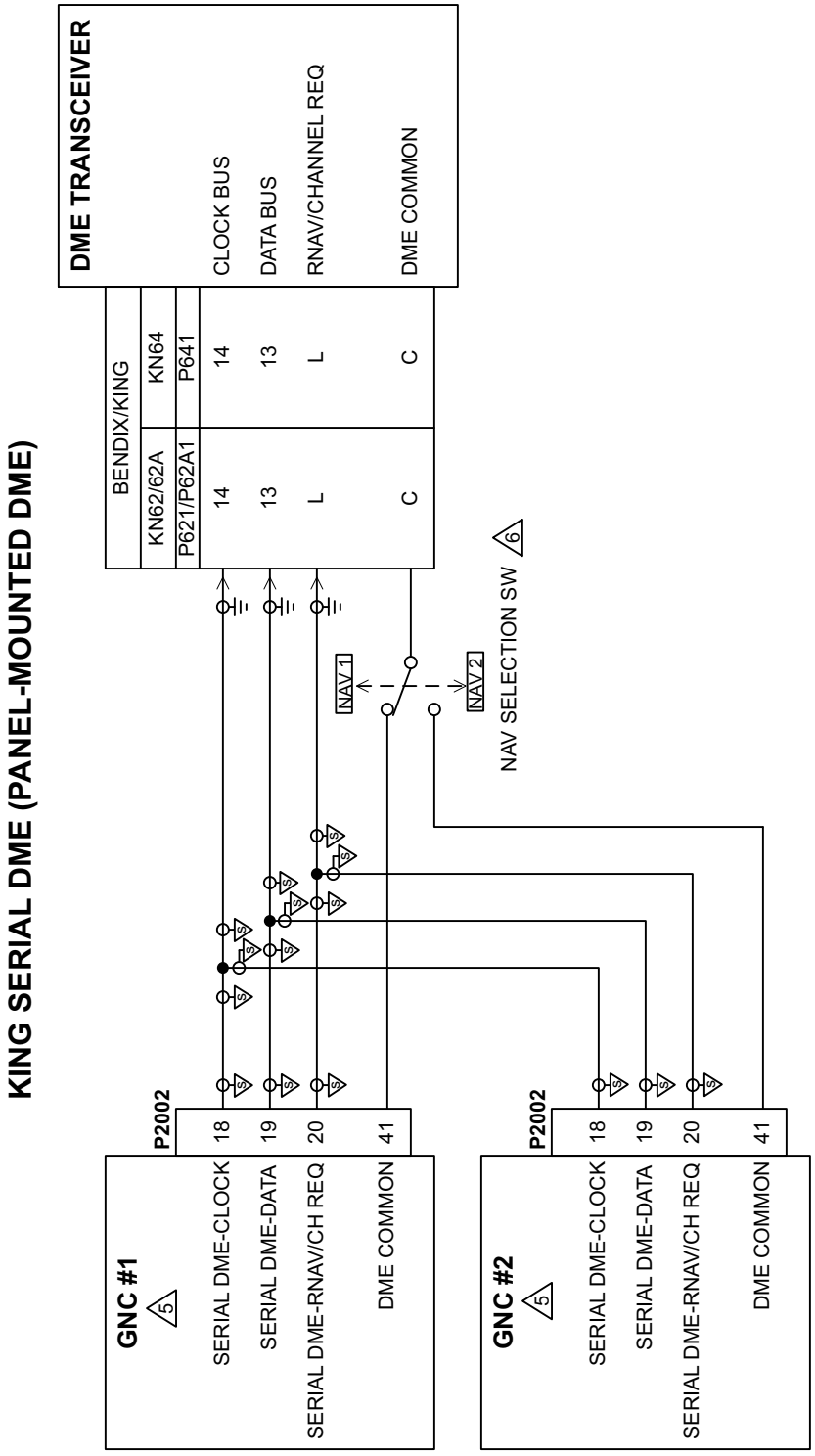



**Figure D-13. GNC - King Serial DME - Panel Mount Interconnect**
**Sheet 1 of 2**

**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND AIRFRAME GROUND

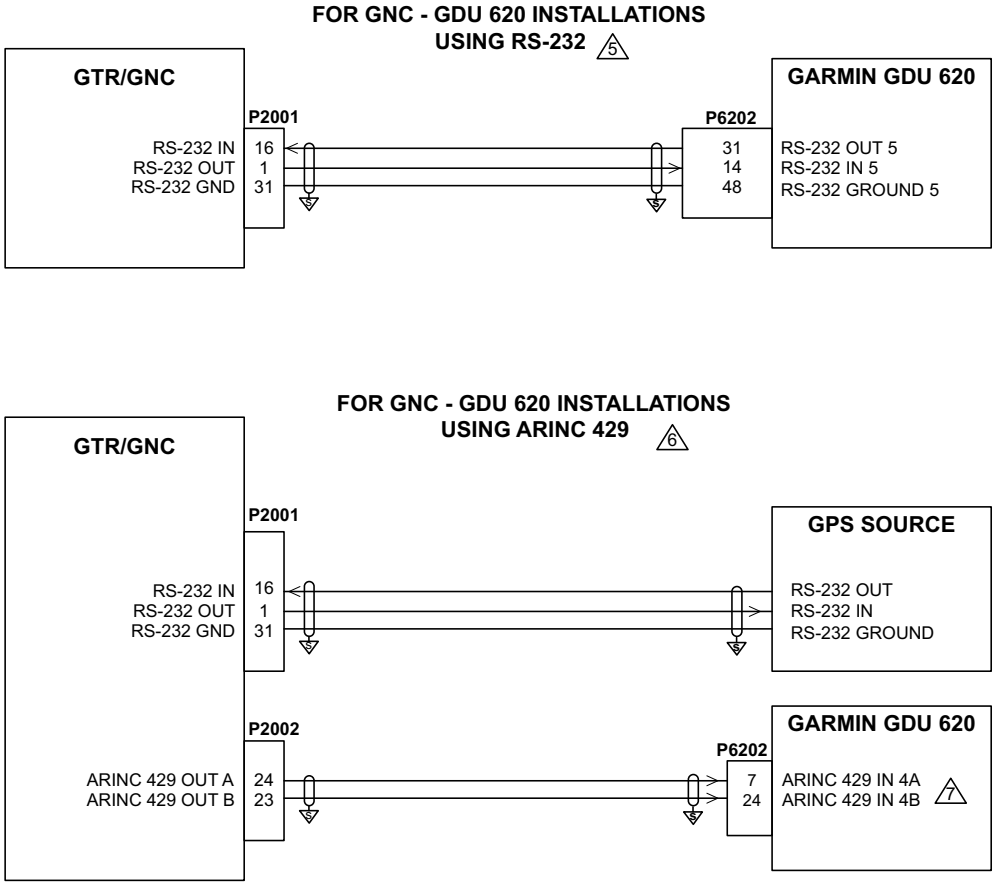
3 AT GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL -- THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIREMENTS. IF NO SHIELD TERMINATION REQUIREMENT EXISTS FOR THE REMOTE EQUIPMENT, TERMINATE SHIELDS AS SHORT AS POSSIBLE, NOT TO EXCEED 3.0". SEE SECTION TBD

4 REFER TO MANUFACTURER'S DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION. PINOUTS OF OTHER UNITS SHOWN FOR REFERENCE ONLY.

5 THE GNC MAY BE CONFIGURED AT INSTALLATION TO OUTPUT KING SERIAL DME TUNING DATA UNDER THE DME CHANNEL MODE. REFER TO SECTION TBD FOR CONFIGURATION SETTINGS.

6 THE NAV SELECTION SWITCH IS ONLY REQUIRED IF TWO GNCS ARE INSTALLED. FOR SINGLE GNC INSTALLATIONS, WIRE AS SHOWN FOR GNC #1. AN ACCEPTABLE SWITCH IS CARLINGSWITCH P/N 112-A-63. LABEL AS SHOWN. REFER TO SECTION TBD FOR ADDITIONAL SWITCH INSTALLATION INFORMATION.

**Figure D-13. GNC - King Serial DME - Panel Mount Interconnect**
**Sheet 2 of 2**




**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND

3 AT GTR/GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL – THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIREMENTS.

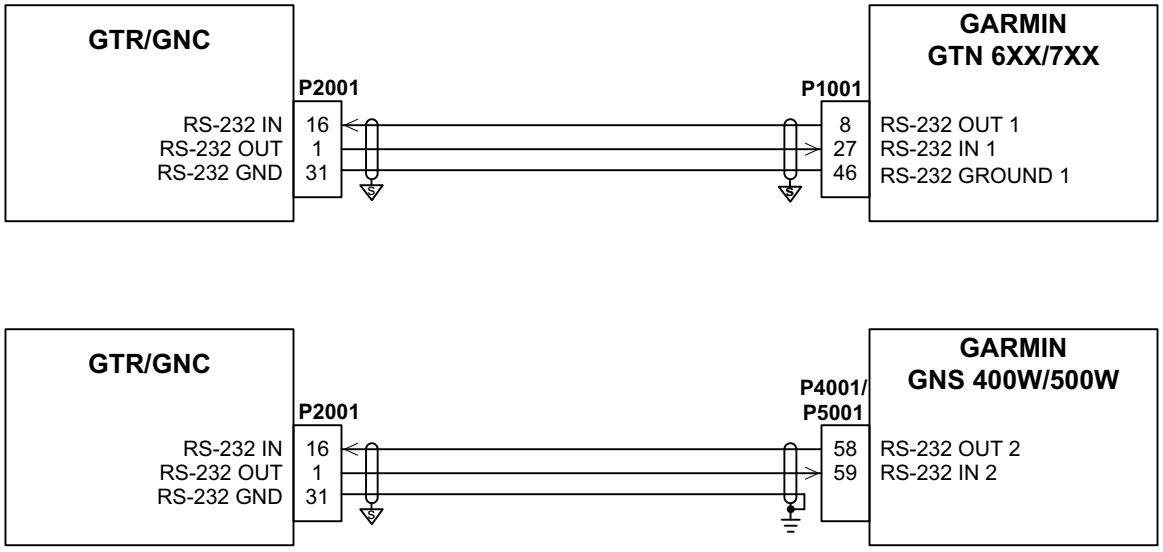
4 REFER TO GARMIN GDU 620 DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION.

5 GDU 620 GPS POSITION FORWARDING TO GTR/GNC IS NOT SUPPORTED IN SOME VERSIONS OF GDU 620 SOFTWARE, SO IT MAY BE PREFERABLE TO UTILIZE THE ARINC 429 INTERFACE TO ALLOW THE RS-232 PORT TO BE USED FOR A GPS SOURCE. CONFIGURE THE GDU 620 TO USE AN RS-232 NAV RADIO, SUCH AS AN SL30. REFER TO THE GDU 620 INSTALLATION MANUAL FOR RS-232 CONFIGURATION DETAILS.

6 SELECTED COURSE INPUT TO THE GNC IS NOT PROVIDED BY THE GDU 620 IN THIS CONFIGURATION. CONFIGURE THE GNC CDI INDICATOR TYPE TO 'NONE'. THE GNC WILL SEND NAVIGATION DATA TO THE GDU 620 OVER ARINC 429, WHICH ALLOWS THE GNC RS-232 INPUT TO BE USED FOR A GPS SOURCE.

7 SEE GDU 620 INSTALLATION MANUAL, 190-00601-04, FOR NAV INPUT OPTIONS AND CONFIGURATION. CONFIGURE THE GDU 620 TO USE AN ARINC 429 NAV RADIO. OTHER ARINC 429 PORTS MAY BE USED ON THE GDU 620.

**Figure D-14. GTR/GNC - GDU 620 Interconnect**




**NOTES:**

1 ALL WIRES 24 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND AIRFRAME GROUND

3 AT GTR/GNC, CONNECT SHIELD GROUNDS TO THE CONNECTOR BACKSHELL – THE SHIELD TERMINATION LEADS SHOULD BE LESS THAN 3.0". CONNECT OTHER END OF THE SHIELD PER THE REMOTE EQUIPMENT INSTALLATION REQUIREMENTS.

4 REFER TO GARMIN INSTALLATION DOCUMENTATION FOR COMPLETE PINOUT AND INTERCONNECT INFORMATION.

**Figure D-15. GTR/GNC - GTN and GNS 400W/500W**

GARMIN